

Citizen Science in Water Quality Monitoring

APPENDICES

MSc Thesis - Ellen Minkman

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Appendix A

Overview of reviewed literature

#	Author	Year	Title	Type	Topic	Location	Citizen science type
[1]	Bonney et al.	2012	Citizen science: a developing tool for expanding science knowledge and scientific literacy	case study	bird count	USA	contributory
[2]	Silvertown	2009	A new dawn for citizen science	case study	birds/snails/ environment misc.	UK/Europe	contributory
[3]	Rothman et al.	2012	Dynamic changes in motivation in collaborative citizen-science projects	survey + interview	environmental monitoring	USA?	contributory
[4]	Roy et al.	2012	Understanding Citizen Science and Environmental monitoring	case study	environmental misc.	UK/Europe	co-created
[5]	Conrad & Hiltchey	2010	A review of citizen science and community-based environmental monitoring: issues and opportunities.	literature review	environmental misc.	misc.	contributory/ co-created
[6]	Buytaert et al.	2014	Citizen science in hydrology and water resources: opportunities for knowledge generation, ecosystem service management and sustainable development.	case study	water resource management	misc. (worldwide)	contributory
[7]	Muller et al.	2015	Crowdsourcing for climate and atmospheric sciences: current status and future potential	case study	climate and atmospheric science	misc.	contributory
[8]	Cooper et al.	2007	Citizen science as a tool for conservation in residential ecosystems	literature review	ecosystem conservation (broad)	Misc	contributory/ collaborative
[9]	He et al.	2015	User privacy and data trustworthiness in mobile crowd sensing	literature review	misc.	misc.	contributory
[10]	Lane et al.	2010	A survey of mobile crowd sensing	literature review	misc.	misc.	contributory

Appendix B

Interview protocol case study

Phase 1: introduction of research

I introduce my studies, myself, the research and the reason that I am here.

I remind the interviewee that he/she will be anonymous and ask permission to switch on the recorder.

Phase 2: introduction of interviewee

I asked the interviewee to introduce him/herself, including:

- 1 Function/role in project?
- 2 Description of project?

Phase 3: questions

I asked the following prepared questions to the interviewee.

Reason to start the project

- 3 Why was this project started?
- 4 What were the goals for the Stream Team project?
 - 4.1 Regarding data collection
 - 4.2 Regarding citizens

Key success factors

- How did you handle...?
 - Project formulation:** goals,
time span,
hypotheses
Measuring method and validation
Community for volunteers
Insight in people's motivation
 - Start:** Training and clear task
Recruitment and marketing
 - During:** Feedback
Retain volunteers
Involvement of citizens in data analysis
Other data collected
Evaluation
Increased task level

Other stakeholders

- What are the partners in [project X]?
- What are the characteristics of the collaboration?

Challenges

- What were the main challenges encountered?
- Say, I am interested in starting a citizen science project in water quality monitoring: what would you advise me not to do?

Lessons learned

- Say, I am interested in starting a citizen science project in water quality monitoring: What would you advise me to do definitely?

Phase 4: final remarks

Interviewees were given the opportunity to give any final remarks

- Do you have any final remarks?

Phase 5: closure

I thank the interviewee for his/her contribution.

I describe the follow-up of the project and I explain that I will send what I intend to use to the interviewee first.

Appendix C

Overview of codes for case study

Below an overview is given of the codes used in analysing the interviews. The codes in bold were pre-defined.

1) REASON TO START

- A) Example
- B) Knowledge
- C) Education
- D) Community resistance

2) GOALS

- A) Science communication
- B) Data collection
- C) Method improvement
- D) Social research
- E) Involve people
- F) Awareness
- G) Support base
- H) Behavioural change
- I) Outreach
- J) Education

3) OTHER

- A) Mobile sensing
- B) Costs
- C) Continuous development
- D) What is citizen science?

4) CITIZEN MOTIVATION

- A) Fun gadget not important
- B) Invested time

5) PARTNERS

- A) What's in it for them
- B) Political neutral
- C) Different audience

6) BEST PRACTICE - BEFORE

- A) Goals**
- B) Time span**
- C) Hypothesis**
- D) Methods**
- E) Validation**
- F) Community**
- G) Insight motivations**
- H) Definition citizen science
- I) Pilot
- J) Examples

7) BEST PRACTICE - START

- A) Training**
- B) Clear task**
- C) Recruitment and marketing**

8) BEST PRACTICE - DURING

- A) Feedback**
- B) Retain volunteers**
- C) Involvement in data analysis**
- D) Evaluation**
- E) Increased task level**
- F) Other data collected**

9) LESSONS LEARNED

- A) social media
- B) Collaboration
- C) Address level participants
- D) User friendly
- E) Pilot
- F) Time investment
- G) Low threshold
- H) Clear protocol

- I) Usefulness
- J) Community
- K) Expertise
- L) Continuous recruitment
- M) Disclaimer
- N) Expectation management
- O) Stimulation
- P) Helpdesk
- Q) Agenda setting

10) PARTICIPANTS

- A) Participants general
- B) Motivation
- C) Characteristics
- D) Threshold
- E) In return
- F) Underestimation

11) CHALLENGES

- A) Collaboration
- B) Database
- C) User friendly
- D) Low threshold
- E) Retain participants
- F) Complexity
- G) Learn in little time
- H) Expectation management
- I) Internal support
- J) Continuation
- K) Privacy
- L) Data accuracy

12) OPPORTUNITIES

- A) Use people's knowledge
- B) Study citizens' problems

Appendix D

Extensive case description

1 Case 1: Tuintelling (Garden Count)

1.1 Case Introduction of Tuintelling

Fact sheet

<i>Interviewed organisation</i>	Vogelbescherming Nederland (2 interviews) Interviewee #1: project leader Tuintelling Interviewee #2: team leader conservation program city birds
<i>Team members</i>	Zoogdier Vereniging EIS (Kenniscentrum Insecten en Andere Ongewervelden) De Vlinderstichting Ravon (amphibians, reptiles, fish) Sovon Floron
<i>Partners</i>	VARA Vroege Vogels (national radio show)
<i>Purpose</i>	Management Outreach Data collection Awareness
<i>Topic</i>	Garden birds
<i>Time span</i>	2015-present
<i>Spatial scale</i>	National
<i>Number of participants</i>	3300 (March 2015), with an aim of 5000 (by end 2015)
<i>Participants</i>	<input type="checkbox"/> elderly women <input type="checkbox"/> higher educated people
<i>FTE investment</i>	2-3 FTE (distributed over the team organisations)

Project background

The Tuintelling (Year Round Garden Count) has been a wish for almost a decade. Interviewee #2 had visited the British Trust of Ornithology (BTO) and was inspired by their year round citizen science project. The project remained an idea for years, but recently it was decided to implement such a project.

“this has been a wish for years, to upscale the annual garden count to a year round.”

Interviewee #1

The programme is co-organised by other organizations, specialised in mammals, amphibians and insects and thus concentrates on city wildlife in general.

Project content

Citizens can choose what species they will monitor, birds or one of the other classes, and they indicate whether they will do a ‘week list’ (where they report qualitatively on all species seen) or a ‘time count’ (where they count the number of animals per species in a certain time slot, ranging from 5 tot 30 minutes). They enter their counts on the website www.tuintelling.nl, a website commonly hosted by the organising partner organisations.



Figure 1.1 – Impression of instructions of the species count as presented on the website www.tuintelling.nl

1.2 Interview results

Goals

The Vogelbescherming has several goals with the project. The main goal of the Year Round Garden Count (Tuintelling) is to increase knowledge about city wildlife, and in the case of Vogelbescherming garden birds. Cities are a blind spot for many species. This data, collected by citizens, will be translated into conservation measures.

“If you want to do something with the results you will need to get more data.”

Interviewee #1

Additional goals are to create awareness about the importance of gardens for nature conservation and correspondingly create a support base for the conservation activities of the Vogelbescherming and make people change their behaviour.

“The idea with this garden count is that people will know what to look for and that they realise how important their garden is for nature. As soon as people consider their garden important, they hopefully realise how important it is that the rest of nature is protected.” (...) *“What we really would like to do is link it to conservation, that people are really going to actively change their garden.”*

Interviewee #1

Finally, the project was also considered an opportunity to involve people and create outreach of the other involved organizations.

“And they [partners] do it mainly to reach the general public, because they are smaller in general.”

Interviewee #2

Time span

The programme was initiated two years ago. The organisation used the time in between to organise the programme thoroughly and to test protocols and websites in a pilot. The programme has an undefined end date, but the goal is to build long-term time series.

“I am glad we took the time to organise this project, to set it up properly.”

Interviewee #2

Hypothesis

The interviewees indicate that there are expectations of the data results, based on the British example of the BTO, where they have a time series of twenty years. The interviewees stress though that they have an unclear image yet.

“When it comes to results, we do not have a clear image yet, we will let it catch us by surprise.”

Interviewee #1

“Hypothesis of the results, well that is what I have said before, the use [of gardens by birds] over the seasons and spreading over cities. It will look like what they collect in the UK”

Interviewee #2

Measuring method

The measuring method is very structured, as it is defined in protocols for counting birds. Existing protocols were taken as example and for each class of species a protocol was formulated. The requirements were that the protocols are easy to use, but still repeatable and independent of the observer. There are two measuring methods, that are equally valuable: a time count, to count the maximum number of one species, and a week, to report everything seen in one week. This week list is a motivaton for citizens as well, as it was noticed that citizens like to report everything they see.

“On the one hand you want to give people an incentive, you want them to stay motivated, that is why we have the week list, you can enter everything you see.”

Interviewee #2

Validation

The data are uploaded to the national data base Flora & Fauna, where the actual validation is done. This validation is based on prior knowledge, for example species that are unexpected at certain times or at certain locations. People can indicate whether they feed the birds, and thus attract them to their gardens, and there is a limit for the numbers one can enter per species. The interviewees further indicate that it is expected that incorrect entries will be averaged out, because the programme aims to collect vast amounts of data. There are furthermore plans to create a community, where citizen scientists can help and correct each other, and to add a feature so that citizens can upload pictures as well. These pictures could be validated by other citizens and by the database Flora & Fauna.

“In the first place it is the mass of citizen science that ensures data trustworthiness, noise is filtered out.”

Interviewee #2

Community

At the moment there is no community, but there are plans to facilitate an online community. In this community citizens would be able to interact with each other and to help each other. It is under investigation whether Facebook could provide in this need.

“But it is more fun if people can help each other. We are investigating whether we can use Facebook this way, that people can upload pictures for each other and can help eachother.”

Interviewee #1

Insight in people’s motivation

A questionnaire was used to gain insight in citizen motivation to participate. Secondly, a pilot of six months was held to test protocols and align communications with the motivations of citizens.

“We did a questionnaire last year and we asked questions like ‘what would you like to do or would be practical, what would you need to continue counting?’ (...) We also did a pilot last year, of six months.”

Interviewee #1

Training and clear task

Citizens that wish to participate can register on the website and are informed that there are two types of measurement. The protocols can be found on the website as well and describe how to count and what to count. The website was designed to be easy to use and easy to understand.

“How you should count and what you should count is on the website.”

Interviewee #2

Recruitment and marketing

Citizens were recruited via the networks of the seven partnering organizations, which have a large outreach together. The programme was announced in newsletters and magazines of the partners. Additionally publicity was sought in national media, for example in a national radio show on nature and environment.

“We used to do that using our own channels, because we are collaborating with seven organizations of course and they all have newsletters and magazines.”

Interviewee #1

Feedback

It will take some time before there are time series and the results aimed for will be available. The Tuintelling will provide feedback in the form of listing what has been done in the meantime. Citizens could also compare their data to that of participating neighbours. Interviewee #1 further mentioned that citizens should be provided with feedback that stresses how important their contribution is, as they may be motivated as they think there is no progress booked.

“(…) that people contribute to general knowledge. That is the most important feedback you want to give.”

Interviewee #1

“In the beginning it will be very much like comparing your garden list to the garden list of the area and the rest of the Netherlands. That is the first feedback there is, but in the end we would naturally want to show what the use is and what knowledge it brought.”

Interviewee #2

Retain volunteers

Regarding participants there are expectations about the drop out rate and it is expected that one third of the participating citizens will be active in data collection, defined as contributing more than ten times a year. One third is expected to be inactive and one third to contribute occasionally, between one and ten times a year. Therefore the project aims at continuous recruitment, via their channels, but also via nature-oriented magazines. The interviewees indicate that they have a long-term relationship with a national radio show, which allows them to regularly highlight the existence of the programme and encourage citizens to participate.

“We have an agreement with them [the radio show] that we will regularly have an item in their show.”

Interviewee #1

“Thus we already started with setting up campaigns, with targeted mailings etcetera.”

Interviewee #1

“But when we started we already knew that it could only persist if we would pay attention to it continuously.”

Interviewee #2

Involvement of citizens in data analysis

Citizens are not involved in data analysis, that is done by the national database Flora & Fauna.

“Well, we did not aimed for that, because it is quite well known how to analyse these data.”

Interviewee #2

Other data collected

Citizens are asked to provide additional information when they start participation. They can indicate what their garden looks like in terms of size and lay-out, for example whether it is paved or how many trees there are. There are plans to combine this information with data from the Central Bureau of Statistics, such as average property prices. At the moment the results are on national and regional scale rather than local.

“People can share the information about their garden themselves, how large the garden is and what is in it.”

Interviewee #2

“With the CBS one can look up per street what the average price of cars is and of houses and those kind of things.”

Interviewee #2

Costs involved

In total there are two or three full-time employees (FTE) working on the project. These 2-3 FTE are spread over the seven partner organizations and most people work part-time on the project.

“Thus in total you have to spend two to three FTE a week and than it becomes expensive, but because you share it together it is doable.”

Interviewee #2

Main challenges

Collaboration with the partner organisations is mentioned as the main challenge by both interviewees. The interviewees stress that there are many advantages of the collaboration, such as increased outreach and exchange of knowledge, but there were also disputes about the approach to follow.

“The biggest challenge in the whole thing is collaboration. The way you communicate was something and how you deal with that is different, so you notice that there are cultural differences in that respect.”

Interviewee #1

“There is a reason that there are different organizations, they all have their interests and their ideas and their wishes and their profiling.”

Interviewee #2

A second challenge mentioned is to provide feedback to participants and stress the importance of participation in the first year.

“This usefulness, that is something where we are still working on.”

Interviewee #1

“How are we going to show these people every time that it is useful that they count, that their garden is important as well. That is still a challenge.”

Interviewee #1

Additional key success factors

Interviewee #1 mentions that the pilot was a large advantage, as it allowed the organisation to fine tune protocols and address issues perceived by participants.

“What really appealed to me was that we did that test. (...) but you notice that it [ask feedback and fine tuning] is very important if you want to reach a large audience.”

Interviewee #1

Interviewee #2 considers a low threshold the most important success factor, at least when it is aimed to reach out to a large audience. This low threshold is reflected in the programme, as citizens can start with tasks that require little knowledge and a small time investment. The protocols are clear and tested extensively in the pilot. Citizens can add more complexity to the tasks if they like to, by reporting more details or extending their counting activities to other classes of species.

“If you want to run a citizen science project, having a low threshold to participate for people is quite important if you aim for a large coverage.”

Interviewee #2

References

-

2 Case 2: iSPEX

2.1 Case Introduction of iSPEX

Fact sheet

<i>Interviewed organisation</i>	RIVM (2 interviews) Interviewee #1: scientist air quality, project leader Interviewee #2: scientist in public administration, spatial and psychology scientist
<i>Team members (iSPEX consortium)</i>	Universiteit Leiden KNMI (Dutch Royal Meteorological Institute) Sterrewacht Leiden SRON (Netherlands Institute for Space Research) TU Delft NOVA
<i>Partners</i>	Longfonds (Lung Fund) KIJK (science magazine for youth) Academische Jaarprijs (Academic Year Award) Avantes CNG Net Milieudefensie (an environmental organisation/Friends of the Earth)
<i>Purpose</i>	Education Increase knowledge Improve methods Social research
<i>Topic</i>	Particulate matter (air quality)
<i>Mobile sensing</i>	iSPEX application (iOS only)
<i>Time span</i>	2012-2015 (data collection in 2013; scientific paper in 2014; social scientific paper expected in 2015)
<i>Geographic scale</i>	National
<i>Number of participants</i>	3187 unique participants (6000 measurements in total).
<i>Participants</i>	Primarily higher educated men (often engineers)
<i>FTE investment</i>	10 (during project), currently <1 FTE

Project background

iSPEX is a smartphone plugin that mimics the measurements of a big SPEX measuring device that measures particulate matter. iSPEX emerged out of the idea to show the general public this device. This idea was submitted for the Academische Jaarprijs (Academic Year Award), an award for the best science communication project.

“(…) built up as crowdsourcing project where you just need a lot of people to establish the data collection.”

Interviewee #2

Project content

iSPEX is named after the iSPEX device, a “low-cost, mass-producible optical add-on for smartphones with a corresponding app.” (Snik et al. 2014, p. 7351). iSPEX was a single event citizen science project organised by the iSPEX consortium (including National Institute for Public Health and the Environment, RIVM). In 2013 people could purchase the iSPEX smartphone accessory and place it on top of their iPhone. They were able to measure particulate matter in the atmosphere using a special smartphone application. Around 3000 people participated (Land-Zandstra et al. 2015, unpublished) on two dedicated measurement days in July and in September 2013. In 2014 the iSPEX consortium published a paper that describes the monitoring method.

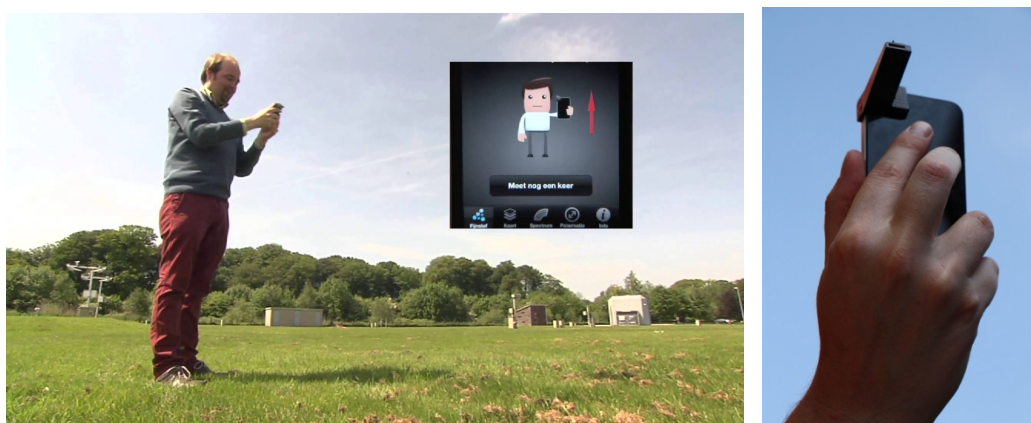


Figure 2.1 – Impression of iSPEX. Left: user in the field, right: close up of iSPEX.

2.2 Interview results

Goals

Education was the main goal of the iSPEX project. On the website it is explained that this goal is twofold, with both the education of the general public and the generation of scientific knowledge as goals. This was confirmed by the interviewees.

“With iSPEX we want to increase knowledge about aerosols among: the general public, by their participation in actual aerosol research, [and] the scientific community, by providing them with an additional source of information which hopefully creates new starting points for follow up research.”

iSPEX website

“On the one hand, iSPEX had won a communication award, so it was indeed the intention to teach people more about their living environment.”

Interviewee #2

“So you cannot escape that us scientists would like to know: what comes out of the measurements. To see what comes out of the data. Yes, but that was very exciting for all of us, a very important goal.”

Interviewee #1

To develop and establish a new measurement method was one of the secondary goals of the project.

“But we really wanted to have a scientific publication, because at the moment that you have a scientific publication, your method is preserved.”

Interviewee #1

Social research into the motivations of citizens was no initial goal, but was added afterwards. A team of scientists studied the motivations of participating citizens in a questionnaire spread after the events.

“At some point they thought: it would be nice to know why people participated, also with the idea in mind that if you want to organise a long-term project, what should you take into account then.”

Interviewee #2

Time span

The intention was to monitor during a couple of days in summer 2013. At the moment there are plans for a follow-up on European scale (www.ispex-eu.org), but it was difficult to ensure sufficient funding. After the interview the project found passage and in September 2015 an European measurement campaign will take place.

Hypothesis

The method to analyse the data was defined along the way, as the time pressure, caused by the schedule of the Academische Jaarprijs, did not allow to do it beforehand.

“At the moment we made the add-ons we made an estimation [of how many measurements needed for averaging]. It turned out to work with 30 or 50 to average, which was better than expected. (...) When we had all the data we had no idea yet how to process it and how to make a map out of it.”

Interviewee #1

Measuring method

The measuring method was based on the full scale SPEX measuring equipment. The idea of iSPEX emerged spontaneously, when an employee built a mini-SPEX to demonstrate its operation. This mini-SPEX turned out to perform in front of an iPhone as well and triggered the idea to use it to educate citizens and collect data. In the final set-up the iSPEX add-on is attached to the smartphone's camera and should be pointed at a cloudless sky for a proper measurement.

“When one of the boys just had a new iPhone, he thought on a Friday Afternoon: ‘I want to know whether this thing [the mini-SPEX] works if I place it in front of my phone’s camera’. And it work, so I was enthusiastic to demonstrate this.”

Interviewee #1

Validation

Several measurements were averaged to obtain a representative value. A scientific data analysis took place to compare the averaged iSPEX measurements to the measurements of the real SPEX measuring devices at the same day.

Insight in people's motivation

There was no research done into the motivation of citizens to participate. Interviewee #1 indicated that they were unaware of the possibility and that there was no time because of time pressure, caused by the time schedule of the Academische Jaarprijs. Interviewee #2 indicated that he joined the project after it was decided to study the motivation of participants afterwards.

“They asked ‘Did you do market research?’ Does that exist? No, we did not do that. (...) So, we decided early in the process: ‘Ok, after we did the measurement days we will spread a survey.”

Interviewee #1

“At some point they thought: it would be nice to know why people participated (...).”

Interviewee #2

Training and clear task

Participating citizens were instructed about the task they had to perform via an online video and guided through the process of doing a measurement by the application. The application would explain to participants how to attach the iSPEX and how to perform the measurement. A warning was given if the add-on was attached incorrect or when the participant had not pointed the iPhone in the right direction.

“It is in the app itself, it guides you through it quite well.”

Interviewee #1

“There is a short instruction video as well.”

Interviewee #1

Recruitment and marketing

The iSPEX project gained momentum by winning the Academische Jaarprijs. Recruitment of participants was further done via the networks of various partner organizations. The most important was the Longfonds, because they had connections to radio and television and because they are a large organisation.

“We participated in the Academische Jaarprijs and that by itself generates a lot of publicity. (...) Twitter and Facebook (...) local newspapers (...) Longfonds (...) KIJK, CGN Net (...) Avantis. They all have a certain network.”

Interviewee #2

“I think that worked really well, to use existing networks of stakeholders.”

Interviewee #2

“iSPEX became a sort of little hype (...)”

Interviewee #2

Participants were recruited via the partner networks, but had to be motivated to do the actual measurements as well. The organisation had to wait for bright days with a cloudless sky. They used several media channels to announce the measurement days. In September a second measurement day was held, but this one was only communicated via internal channels. An email was sent to all registered users of iSPEX to announce the monitoring day. This resulted in less, but sufficient measurements.

“In September we held another measurement day and we kept it out of publicity purposely. We only sent an email, a push message saying that we would measure again now.” (...) “A few hundred people continued measuring, that turned out to be enough to incorporate that day of measurements [in the analysis].”

Interviewee #1

Feedback

Direct feedback was provided to the participants in the form of an interactive map, where their measurement was added immediately. Feedback on the accuracy of these data points and a translation of data into maps took longer than expected. There was almost a year between the initial measurements and the release of these maps. This delay was depreciated by several participants, although most could understand the reasons.

“We had thought about it, that we wanted a direct, instantaneous result with a coloured dot on the map. But the final results where these dots were reliable and maps were made, that took more than half a year. That is superfast for a scientific publication, but for communication to the public it is very long.”

Interviewee #1

“(...) there were a few that were pissed off that the results took so long [but] most people were understanding .”

Interviewee #1

Retain volunteers

iSPEX was a short-term citizen science project, retention of volunteers was thus hardly an issue. A couple of hundred people continued measuring after the official, pre-announced monitoring days. The application is still operational though and at the day of interview there was one dot on the interactive map, indicating someone measured in the past 24 hours.

Involvement of citizens in data analysis

Data was analysed by scientists, without involvement of citizens.

Other data collected

Additional data was collected in the form of the questionnaire spread after the measurement days took place.

Costs involved

Several people are involved behind the scenes, Interviewee #1 estimates that ten to twenty people were involved fulltime around the measurement days. These were people from different organizations and involved in data processing, producing the maps and communication.

“It is not as if twenty people were working on it the whole day. Maybe around ten people full time and the others, well, maybe it were more than 20, ah well.”

Interviewee #1

At the moment there is a task force with one person per institution, which are not committed full time to the project. This time investment and associated costs are a bottleneck for continuation though. There are some plans for a European follow-up of the project, but there is insufficient funding.

“That is a general problem with these kind of projects: everybody finds it interesting when it is new, but as soon as you need to make the next step...” (...) “They do not say ‘Here is 300 000 euro to develop that measuring method further.’”

Interviewee #1

Main challenges

The main overall challenge as perceived by interviewee #1 was expectation management. Citizens expected that they were measuring how polluted their environment was, but this cannot be measured with iSPEX, which measures aerosols in the atmosphere. Citizens expected that they would measure how clean their environment was and that their measurements would influence pollution policy if they would measure high aerosol levels.

“I see here at expectations (...) that it could be used for environmental policy and that it can be used to influence health regulations. Well, that is not true.”

Interviewee #2

Not only had citizens wrong expectations, partner organizations mentioned these incorrect beliefs in their communication. It was a challenge for RIVM to align communications and explain partners why they could not claim to solve issues with particulate matter.

“One of the first things XXX [partner X] said was: ‘we are going to solve the problems with particulate matter.’ Ho stop, you cannot say that (...) sometimes it is a subtle difference: if you say it like this it is okay indeed.”

Interviewee #1

In the start-up of the project the main challenge was to create internal support. Employees at RIVM feared that the project would communicate errors. Colleagues of interviewee #1 indicated that they disagreed with simplifications made and demanded a disclaimer of what iSPEX was and what it did not measure, namely pollution at street level. Interviewee #1 still regrets this disclaimer, because it was a negative communication means.

“(...) but what I faced mostly from the beginning was the communication internally.”

Interviewee #1

“I did it [disclaimer] because I felt that I had to at the moment, because otherwise I could not get them to go through with it.”

Interviewee #1

Additional key success factors

The iSPEX team installed a help desk, where people could pose their questions concerning the application, the add-on or the project in general. Responses were relatively fast, ranging from one day to ten minutes. Interviewee #1 believes that citizens appreciated this service.

“People received direct answers and personal attention. ‘I am being helped so that I can join the measuring.’ ”

Interviewee #1

Interviewee #1 indicates that iSPEX served as an agenda setting project. The project drew attention to citizen science as a serious option for data collection and communication. There is an increased interest in citizen science projects. That was reflected by an internal symposium that attracted 60 to 70 people, a high number according to interviewee #1.

“You can see that the idea has landed that this is an interesting option and that we should do something with it. That is supported widely now.”

Interviewee #1

References

Land-Zandstra, A.M., Devilee, J.L.A., Snik, F., Buurmeijer, F. & Broek, J.M. van der (2015) Citizen Science on a Smartphone: Participants’ Motivations and Learning. Under review/upublished.

Snik, F., Rietjens, J. H., Apituley, A., Volten, H., Mijling, B., Di Noia, A., ... & Keller, C. U. (2014). Mapping atmospheric aerosols with a citizen science network of smartphone spectropolarimeters. *Geophysical Research Letters*, 41(20), 7351-7358.

3 Case 3: Crowdsourcing in Reeuwijkse Plassen

3.1 Introduction of Crowdsourcing in Reeuwijkse Plassen

Fact sheet

<i>Interviewed organisation</i>	Hoogheemraadschap van Rijnland (Water Authority) Interviewee #1: current project leader (currently involved) Interviewee #2: multiproject manager for the plan of implementation (involved at project definition)
<i>Team members</i>	-
<i>Partners</i>	Mobile Water Management
<i>Purpose</i>	Policy justification Education Data collection
<i>Topic</i>	Water levels
<i>Mobile sensing</i>	Mobile Water Management application (iOS and Android)
<i>Time span</i>	2014-2016
<i>Geographic scale</i>	Local
<i>Number of participants</i>	Currently 10
<i>Participant profile</i>	Senior, male citizens
<i>FTE investment</i>	Unknown

Project background

Part of the Reeuwijkse Plassen (lake area of Reeuwijk) is a Natura 2000 area (see also XXX). Water authority Rijnland has been taking measures to comply with the Water Framework Directive (WFD) of the European Union in the period 2010-2014 (Hoogheemraadschap van Rijnland 2009).



Figure 3.1 – The area of the Reeuwijkse Plassen, where recreation and nature had to be balanced in the Plan of Implementation 2010-2014. In the left upper corner is the town of Reeuwijk, in the left lower corner the city of Gouda. (Hoogheemraadschap van Rijnland 2009)

Fifteen sub-projects were implemented in this 25 million euro project. The sub-project of installing a more flexible water level faced resistance of residents and interest groups. A feedback group was installed to discuss the plan of implementation and balance nature, recreation and interests of stakeholders.

“Reeuwijk has a relatively assertive environment and there are around 25 interest groups in the area, six or seven of which were in in the feedback group.”

Interviewee #2

The water authority was challenged by misperceptions of citizens regarding the water system and distrust against the information spread by the water authority.

There is actually “little knowledge about water, the knowledge available was transferred from father to son. (...) there is little real knowledge about the relation between [surface water] and what groundwater actually is.”

Interviewee #1

Many people think, if we lower the water level in summer more compared to what we do now, that their house will face more rapid subsidence and that if we increase it in winter, their houses will be flooded more often.”

Interviewee #1

Water authority Rijnland was inspired by another water authority that used participatory monitoring, i.e. citizens that perform the actual monitoring task of collection data. The specific set-up of the project in Reeuwijk was defined by the water authority in combination with Mobile Water Management (MWM), a spin-off company of TU Delft.

“We ‘stole’ [the idea of] participatory monitoring from Waternet so to say, because they were doing that. To do it with an application, that is our own invention.”

Interviewee #2

Project content

The field of interest of the project is 10 senior citizens monitor groundwater water levels in their backyards and monitoring surface water levels in their surroundings. They use an application of Mobile Water Management (MWM). Participants take a picture with their smartphone of a staff gauge. The picture is uploaded to a server and an image recognition algorithm processes the picture and returns a value. The groundwater levels are currently measured with using echo sounds. A beep is send into a monitoring tube and based on the echo the water depth is determined using specialised software. Participants can choose when and how often they upload pictures and thus collect data.

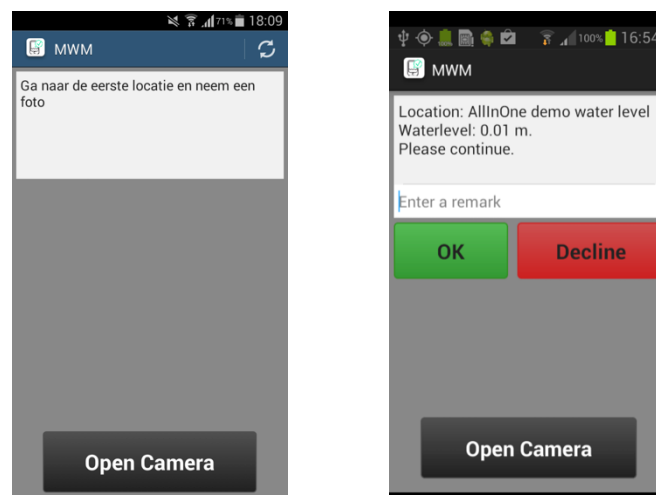


Figure 3.2 – Screenshots of the application of Mobile Water Management to monitor surface water levels.

3.2 Interview results

Goals

The most important goal was to increase knowledge about the relation between groundwater and surface water levels.

“The dynamics of groundwater and surface water, you expect a difference of course, but you cannot proof that if there are no full time series.”

Interviewee #1

“Well, because we want to provide insight into the relation between groundwater and surface water.”

Interviewee #2

Secondly, the water authority uses the project to create a support base for their new water level policy. They use the project to show that they do listen and want to work together with citizens. The water authority wants to show that they look at the true situation and that their facts are real.

“It is positive for the justification of our water level decision.”

Interviewee #1

“(…) to create a support base for the water level policy. (…) by working with shared information, such that people experience it themselves, we expect it to be easier.”

Interviewee #2

According to the interviewees one of the goals of the project was also to learn together.

“But also learn together.”

Interviewee #1

“Well, we also focused on communication and education.”

Interviewee #2

The interviewees indicate that they hope that citizens will learn more about groundwater dynamics and understand what how the water systems works.

“It could be that we find out that it is different than we thought and than we should be willing to do not push our decision.”

Interviewee #1

“And if it turns out to be different, it has consequences for your water level policy, than you might have to do that differently.”

Interviewee #2

“We want them [citizens] to understand what is happening, that they understand how groundwater levels arise near their house.”

Interviewee #1

Although the interviewees indicate to believe the water authority is right that the new water level policy will do no damage, they both indicated that they are aware that the water authority might be wrong as well. In that case the water authority should reconsider the water level policy.

“We really want people to learn how the system works, such that they do not have to worry about things that are not happening at all.”

Interviewee #1

“Well, because we want to provide insight into the relation between groundwater and surface water.”

Interviewee #2

Time span

The project has a pre-determined time span of two years. There will be an initial period of one year, after which the project will be continued for one year, if successful. The implementation of the new policy level is delayed with one year by this mobile crowd sensing project.

“We are going to measure for one year, before we start with the remainder of the preparation of the policy level decision.”

Interviewee #1

“We measure two years (...) and after one year we will see and start the procedure for the water level decision, because at that time we will have results that form a base to continue.”

Interviewee #2

Hypothesis

The mobile crowd sensing project started after a decision to change the water level policy. The water authority thus had a clear hypothesis in mind, namely that the groundwater level is merely influenced by precipitation than surface water levels.

“Our image was that you could see that this relation, that groundwater is much more influenced by rain water and much less by surface water.”

Interviewee #2

Measuring method

Interviewee #1 indicated that they estimated of how many tubes they would need and at what locations. Participants could further use the application at a self-chosen moment, as there are no fixed monitoring moments.

“I think that you should definitely know beforehand how many measurements you need.”

Interviewee #1

“Well, I believe the discussion was especially about how many groundwater tubes and how many surface water tubes and where and how far from the houses [they need to be].”

Interviewee #2

Validation

The water authority using automatic loggers validates the data. The data points collected by the participating citizens are compared to the time series generated by the automatic loggers of the water authority.

“We place a logger next to all groundwater tubes that they [citizens] measure and we monitor the surface water levels at multiple places automatically.”

Interviewee #2

Community

The project does not have an official community established and participating citizen do not originate from the same group, but the interviewees believe that the participants feel connected to the project. The project is a pilot, which means some elements have to be thought out while running. This creates

a feeling of being part of something, according to interviewee #1, because the water authority, the software developer and the citizens have to develop the project together. This commitment of the participating citizens was reflected in the reflection evening in spring 2015, where six out of ten participants were present and one apologized for forgetting the meeting.

“(...) it is very nice that the pilot gives a group feeling. People do not mind to be used as a guinea pig, that gives a feeling like ‘we are permitted to do this’.”

Interviewee #1

Insight in people’s motivation

There was no insight in people’s motivation to participate. The interviewees both indicated that the concerns of citizens were already known via the feedback group and there are some people known for having a critical attitude towards the project. The water authority had an idea of citizen motivational factors this way and offered them to participate in the project as designed by them.

“We just offered them something, that was a one-sided decision.”

Interviewee #1

“Well, I think you expect it from some people indeed, because they are interested in investigations and measurements in our control area. Thus they closely watch our moves and from others you expect it because they are concerned or wanted to know how things work themselves.”

Interviewee #2

Training and clear task

All participants received an individual training for doing the measurements via the application. Individual instruction was preferred over group instruction, as it was expected that participants would not ask questions about the application in a group. The monitoring method to determine groundwater depth was changed from a measuring tape to an echo sound method. Participants received an individual training of both someone from the water authority and the developer of the application, in which they were instructed on how to use the changed application. Participating citizens were instructed in the field, because they received an explanation of the monitoring tubes that had to be drilled on their properties and because it offered the participants hands-on experience during instruction.

“You could do it during such a general session, but they will not ask questions then. (...) it should be done personally, giving this instruction .”

Interviewee #1

If “(...) something changes, they go to all participants to explain that we will monitor groundwater tubes in a slightly different way.”

Interviewee #2

Whether the task was clear was not discussed in the interview, although interviewee #1 indicated that some participants struggle with using the application.

Recruitment and marketing

Participants were recruited via the feedback group and via a call to participate in a local newsletter. The group is smaller than expected, although the interviewees do not see this as a disadvantage. They indicate to rather have an active, motivated small group and interviewee #1 adds that the chosen procedures are rather time-intensive.

“The feedback group was asked to use their network or whether they would like to participate themselves (...) and additionally it was advertised in the newspaper.”

Interviewee #2

“Somehow that [the number of participants] was disappointing, but having an active group it is very valuable as well.”

Interviewee #2

“I think ten [locations] is enough for the area.”

Interviewee #1

Feedback

Participants are provided with direct feedback in the application, in the form of the water level measured at that time and location. The results were discussed on the reflection evening in spring 2015 and a second reflection evening is planned for fall 2015. The water authority is working on an online viewer [which is operational at the time this thesis is published] to provide real-time insight in time series at different locations.

“We have had the information evening and we are trying, but it is rather complex, to create a viewer. (...) After the summer we are going to do another evening, such that they [citizens] can see the results throughout summer.”

Interviewee #1

“In fact, such that you can see it real-time. That people can puzzle themselves with it, via internet.”

Interviewee #2

Retain volunteers

There was no recruitment of additional or new participants, because of the limited time span and the goals of the project. Time series of the second year only would be useless if there is no historical data on that location.

“(...) but installing a monitoring tube someplace where you do not know the history of the previous level, that is actually of little use.”

Interviewee #1

Involvement of citizens in data analysis

In Crowdsourcing in Reeuwijkse Plassen (CiRP) the participating citizens are actively involved in data analysis during the reflecting meeting in spring 2015. The water authority prepares a preliminary analysis, but also discusses the raw data with the participants. One participant received the whole data set, so that he could analyse them thoroughly himself.

“Naturally we do an analysis and present it. This is not a polished version: we present the raw data and tell them what we noticed. And then, what do you [citizens] notice and are there other things?”

Interviewee #1

Other data collected

The interviewees indicated that citizens do not collect additional data besides the groundwater and surface water levels. The water authority itself collected soil data when drilling the monitoring tubes though at the start of the project. Interviewee #1 mentions that it is an advantage that the participants report on incidents with the staff gauges, such as invisible or ill-placed gauges.

“Additionally you hear a bit faster that staff gauges are invisible or that kind of things. (...) It turned out that some gauges were placed inconvenient. (...) They are placed with an angle to the banks, such that you cannot read them. Yes, if you walk 20 meters that way, but than you cannot read it anymore.”

Interviewee #1

Costs involved

Several persons are part-time involved in the project. There is a project leader and water authority employees that handle the instruction of participants and the validation, integration in the water authority's database Fuse and analysis of the data. At Mobile Water Management at least one person is working part-time on the project. Overall, both interviewees classify the project as 'labour-intensive'.

"I am involved, I am the access panel, they [citizens] always come to me. But then behind the scenes, XXX [Mobile Water Management] is working on it a lot. Next the data, that come in via Fuse, so they have to be validated. It should be added to Fuse in the right way, thus it has to be checked, so at monitoring they are also working on it."

Interviewee #1

Main challenges

The interviewees mentioned technological issues and recruiting enough people as the main challenges. The water level policy is the only sub-project that is not implemented yet, therefore the feedback group was dismissed. Questions regarding how to communicate the results are a new challenge, since the feedback group is recently terminated.

"Making it work technologically." [as a reply to the question of the main challenges]

Interviewee #1

"Only this project is still running and that makes that we are still searching: how do we discuss this, now that we do not have a feedback group anymore?"

Interviewee #2

Additional key success factors

The main key success factor mentioned is the personal contact between the water authority and citizens. The commitment of participants was, according to the interviewees, triggered by personal contact at the instruction of participants and at the reflection meeting. The installation of a manager that stayed involved over the whole process was innovative and perceived as successful by interviewee #2.

"I think that it is a success that we just have continuity in the contact persons. We assigned an area manager that also [was involved in] the execution phase. It was someone who talked to a lot of parties in the preparation phase, but who also did the execution. That was something that we have not done before at Rijnland."

Interviewee #2

References

Hoogheemraadschap van Rijnland (2009) Schoon en mooi: uitvoeringsplan Reeuwijkse Plassen en omstreken [Clean and beautiful: plan of implementation lake area Reeuwijk and its surroundings]. Hoogheemraadschap van Rijnland, Leiden, The Netherlands. Available at: <http://www.rijnland.net/werk-in-uitvoering/plassen-en-meren/downloads-plassen-en-meren/uitvoeringsplan-schoon-en-mooi.pdf>

Appendix E

Full survey

Enquête citizen science en vrijwilligerswerk

Enquête citizen science en vrijwilligerswerk

Hartelijk dank dat u mee wil doen aan mijn enquête.

Mijn naam is Ellen Minkman. Ik studeer watermanagement en wetenschapscommunicatie aan de TU Delft. Voor mijn afstuderen onderzoek ik citizen science. Deze enquête is een belangrijk onderdeel van mijn onderzoek. Uw deelname waardeer ik dan ook heel erg! Het invullen van de enquête kost ongeveer twintig minuten.

Citizen science (burgerwetenschap) zijn alle projecten waarbij burgers gegevens verzamelen, analyseren of interpreteren op een wetenschappelijke manier of voor een wetenschappelijk doel. Bekend zijn de jaarlijkse vogeltellingen, maar bijvoorbeeld ook het meten van fijnstof met je smartphone (iSPEX) is citizen science. Ik onderzoek de mogelijkheden voor citizen science samen met het Zuid-Hollands Landschap en een waterschap.

Deze vragenlijst bestaat uit drie delen. Het eerste deel verzamelt algemene informatie. Het tweede deel vraagt naar uw mening over een toekomstig citizen science project en deel drie gaat over de technologie die we daarvoor willen inzetten.

Uw antwoorden zullen alleen gebruikt worden voor mijn afstudeeronderzoek. Uw reacties en gegevens geven wij niet door aan derden en u wordt niet benaderd naar aanleiding van uw antwoorden op deze enquête.

Klik op volgende voor het starten van de enquête.

Deze eerste vragen verzamelen algemene informatie over uzelf.

Geslacht

- Man
- Vrouw

Leeftijd (in cijfers, bijvoorbeeld: 44)

Wat zijn de vier cijfers van uw postcode?

Wat is uw hoogst genoten opleiding?

- Geen opleiding
- Basisonderwijs/Lagere school
- VMBO
- HAVO
- VWO
- MBO
- HBO
- WO
- Anders, namelijk: _____

Hoeveel uur per week werkt u gemiddeld?(Meerdere antwoorden mogelijk)

- Minder dan 10 uur betaald werk
- 10-20 uur betaald werk
- 20-40 uur betaald werk
- Meer dan 40 uur betaald werk
- Ik ben gepensioneerd
- Ik ben werkzoekende
- Ik ben student

Heeft u toegang tot een tablet of smartphone (zakelijk of privé)? Bijvoorbeeld omdat u zelf een smartphone of tablet heeft, of omdat u de tablet/smartphone van uw partner kunt gebruiken.

- Ja, beide
- Ja, een tablet
- Ja, een smartphone
- Nee

Heeft u ervaringen met het gebruik van applicaties (apps)?

- Ja
- Nee

U heeft aangegeven dat u nog nooit een smartphone heeft gebruikt. Mijn afstudeerproject gaat over een smartphone applicatie. De rest van de vragen gaan over deze applicatie. Er zit een handleiding die u helpt bij de rest van de vragen. Ik zou u willen vragen om de enquête toch verder in te vullen, omdat dit mij diepere inzichten geeft. Mocht u toch willen stoppen kunt u dat hieronder aangeven.

- Ja, ik ga door met de enquête.
- Nee, ik wil toch stoppen.

U heeft aangegeven geen toegang te hebben tot een smartphone, maar wel tot een tablet en u heeft ervaring met apps. U kunt daarom gewoon meedoen aan de rest van de enquête. In de rest van de enquête noem ik wel alleen 'smartphone' en niet meer 'smartphone of tablet'.

Geef hieronder aan in hoeverre u het eens bent met de volgende stellingen.

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Het gebruik van een smartphone schrikt mij totaal niet af.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ik weet hoe ik een applicatie kan downloaden uit de App Store/Google Play Store en hoe ik die app vervolgens moet openen.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Het gebruik van een smartphone maakt mij nerveus.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Het gebruik van een smartphone vind ik niet prettig	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Mijn smartphone-gebruik zou ik omschrijven als:

	Helemaal oneens	Grotendeel s oneens	Deels oneens	Neutraal	Deels eens	Grotendeel s eens	Helemaal eens
Gaat als vanzelf	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ik ben steeds op zoek naar nieuwe dingen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ik gebruik een smartphone voor mijn plezier	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Heeft u eerdere ervaringen met het gebruik van applicaties die gegevens verzamelen?

- Nee
- Ja, een sportapp
- Ja, een gezondheidsapp
- Ja, een app om gegevens te verzamelen (bijvoorbeeld vogeltellingen of iSPEX voor fijnstofmetingen)
- Ja, anders namelijk: _____
- Weet ik niet

	Helemaal oneens	Grotendeel ls oneens	Deels oneens	Neutraal	Deels eens	Grotendeel ls eens	Helemaal eens
In het algemeen is mobiel internet nu een goede omgeving om informatie uit te wisselen.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ik ben er zeker van dat het Zuid-Hollands Landschap vertrouwelijk omgaat met mijn gegevens.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

De komende vragen gaan over uw relatie met het Zuid-Hollands Landschap.

Ik ontvang de nieuwsbrief van het Zuid-Hollands Landschap, omdat:

- ik donateur/beschermer ben
- ik vrijwilliger ben
- ik mij daarvoor het aangemeld
- anders, namelijk: _____

Ik ben over het algemeen tevreden met:

	Helemaal oneens	Grotendeels oneens	Deels oneens	Neutraal	Deels eens	Grotendeels eens	Helemaal eens
mijn interactie met het Zuid-Hollands Landschap.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
de services van het Zuid-Hollands Landschap.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Het Zuid-Hollands Landschap:

	Helemaal oneens	Grotendeels oneens	Deels oneens	Neutraal	Deels eens	Grotendeels eens	Helemaal eens
is een organisatie die beloftes en verplichtingen nakomt.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
heeft een slechte reputatie onder de natuurbeheerders.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
heeft een reputatie van betrouwbaarheid.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Bent u actief als vrijwilliger of de afgelopen vijf jaar actief geweest als vrijwilliger?

- Ja, bij het Zuid-Hollands Landschap
- Ja, bij een andere organisatie
- Nee

Dit was het eerste deel van de enquête. Door op volgende te klikken gaat u door naar deel twee. U krijgt eerst een inleidende tekst te zien.

VRIJWILLIGERSWERK: SAMEN VOOR DE REGIO

Wilt u zich actief inzetten voor uw eigen omgeving? Wij kunnen uw hulp als vrijwilliger goed gebruiken, zowel buiten in het veld als binnen op kantoor. Voor onze stichting zijn ongeveer 300 vrijwilligers actief. Ze vormen een belangrijke spil van de organisatie, die het draagvlak voor natuur onderstreept. Wat onze vrijwilligers doen is heel divers. Ze werken bijvoorbeeld in een bezoekerscentrum, knotten wilgen en onderhouden paden op landgoederen. Ook u kunt vrijwilliger worden van het Zuid-Hollands Landschap. Er is van alles te doen: leuk werk waarmee u een steentje bijdraagt aan natuur en recreatie in de buurt.

NIEUW PROJECT

Komend jaar willen we een nieuw project starten. In dit project willen we samen gaan werken met de Technische Universiteit Delft en het waterschap.

Samen met het waterschap werken wij momenteel aan een transformatie van agrarisch gebied naar natuurgebied. Ons doel is om de waterkwaliteit te verbeteren, waardoor het gebied aantrekkelijk wordt voor waterplanten, waterdieren en weidevogels. Dit doen wij door op verschillende locaties maatregelen te nemen. Hier wordt bijvoorbeeld het watersysteem veranderd, wordt er extra gebaggerd en wordt het waterpeil flexibel, waardoor er in de winter hogere waterstanden zijn dan in de zomer.

Wij willen weten hoe het gebied zich ontwikkelt de komende vijf jaar. De TU Delft, het waterschap en het Zuid-Hollands Landschap zetten samen een burgerwetenschap (citizen science) project op. Burgers zijn hierin als vrijwilliger actief om gegevens te verzamelen. Deze gegevens zullen gebruikt worden voor monitoring, voor wetenschappelijk onderzoek en voor het beheer van het gebied.

Op dit moment wordt alleen ecologie in het gebied gemonitord door enkele vrijwilligers. In dit nieuwe project willen we twee aspecten van waterkwaliteit toevoegen: chemische waterkwaliteit en waterdiepte. Ook willen wij met meer vrijwilligers gaan werken en de gegevens op een wetenschappelijke manier verwerken.

WAAR KUNT U AAN DENKEN?**Ecologische monitoring**

Als u ecologisch gaat monitoren verzamelt u informatie over bepaalde plantensoorten.

Hierbij gaat het om zogenaamde indicatorsoorten: soorten die alleen bij een goede waterkwaliteit voorkomen, zoals algen, waterlelie, plomp en krabbescheer. We houden bij welke soorten op welke locatie aanwezig zijn.

We vragen u ook om in te schatten hoeveel procent van het water bedekt is door de soorten die aanwezig zijn. U kunt hiervoor gebruik maken van kaarten waarop de soorten beschreven staan.

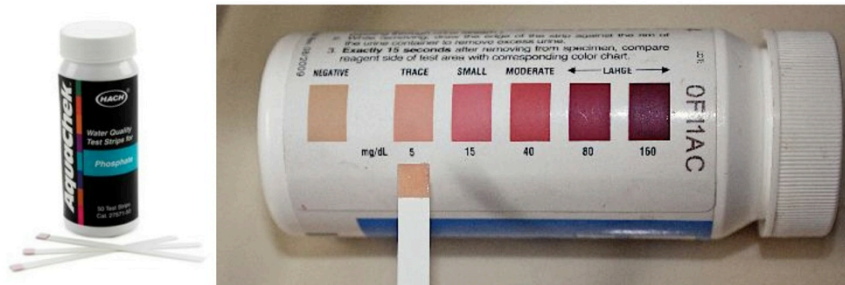


Chemische waterkwaliteit

We verzamelen informatie over twee stoffen die opgelost zitten in het water: chloride en fosfaat.

Chloride geeft informatie over hoe zout het water is en fosfaat over hoeveel nutriënten (voedingsstoffen) er in het water zitten. Als het water te zout is of er teveel nutriënten in zitten kan dit negatieve gevolgen hebben voor de waterkwaliteit.

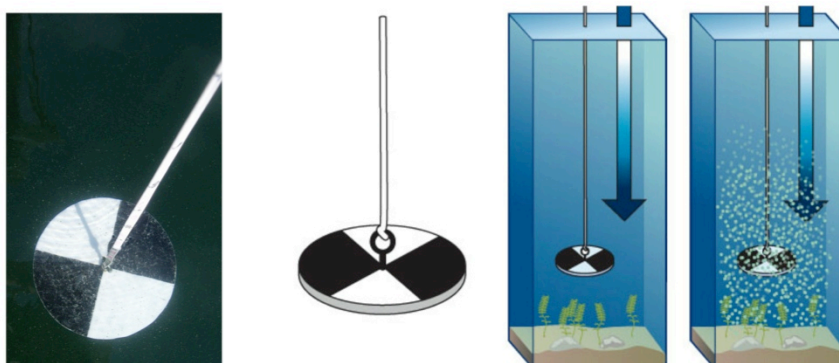
We bepalen de concentratie van deze stoffen door een teststrip in het water te houden en vervolgens te vergelijken met een legenda.



Waterdiepte doorzicht

Veel watergangen in Nederland zijn troebel. Hoe troebel het water is bepaalt tot hoe diep zonlicht door kan dringen. Dit is belangrijk voor waterplanten, omdat zij zonlicht nodig hebben om te overleven.

We meten dit door een zogenaamde Secchi schijf in het water te laten zakken. De metalen schijf is 20 cm in doorsnede en bestaat uit witte en zwarte vlakken. Op het moment dat u de schijf niet meer ziet haalt u de schijf weer op en kijkt tot waar het meetlint nat geworden is. Dit is de doorzichtigdiepte, gemeten in meters.



Voor de komende vragen gaan we er van uit dat project zich afspeelt in een natuurgebied bij u in de buurt. Met de knop 'vorige' kunt u terug naar de omschrijving van het project.

Geef hieronder aan in hoeverre u het eens bent met de volgende stellingen.

	Helemaal oneens	Grotendeels oneens	Deels oneens	Neutraal	Deels eens	Grotendeels eens	Helemaal eens
Het lijkt mij leuk om vrijwilligerswerk (monitoring) te doen bij het Zuid-Hollands Landschap.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ik heb de intentie om vrijwilliger (monitoring) te worden bij het Zuid-Hollands Landschap.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ik heb de intentie om mee te doen aan dit specifieke project.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Hoeveel uur per maand zou u gemiddeld actief willen zijn als vrijwilliger bij dit project?

- 0 uur
- Minder dan 2 uur
- 2-5 uur
- 6-10 uur
- Meer dan 10 uur

Als ik meedoe aan dit project zou ik informatie willen verzamelen over:

	Helemaal oneens	Grotendeels oneens	Deels oneens	Neutraal	Deels eens	Grotendeels eens	Helemaal eens
Ecologie	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Chemische waterkwaliteit	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Waterdiepte	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Geef hieronder aan in hoeverre u het eens bent met de volgende stellingen.

	Helemaal oneens	Grotende els oneens	Deels oneens	Neutraal	Deels eens	Grotende els eens	Helemaal eens
De toevoeging van chemische waterkwaliteit aan het monitoren van ecologie beïnvloedt mijn intentie tot deelname negatief.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
De toevoeging van waterdiepte (doorzicht) aan het monitoren van ecologie beïnvloedt mijn intentie tot deelname negatief.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ik vind het hinderlijk om een doosje stripjes (past in broekzak) mee te nemen naar de locaties waar ik ga monitoren.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ik vind het hinderlijk om een Secchi schijf (past in normale (rug)tas) mee te nemen naar de locaties waar ik ga monitoren.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Als de materialen die nodig zijn bij het doen van metingen in mijn (rug)tas passen, vind ik het geen probleem om die zelf mee te nemen.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Hieronder staan een aantal redenen waarom u mee zou kunnen doen aan een citizen science project. Geef voor elke reden aan of u dit belangrijk of onbelangrijk vindt. Geef vervolgens aan welke drie redenen u het meest belangrijk vindt. Als ik meedoe aan dit project, vind ik het _____ (vul in belangrijk/onbelangrijk) dat:

	dan vind ik dat:		Meest belangrijk/onbelangrijk	
	Onbelangrijk	Belangrijk	Meest belangrijk (max. 3)	Minst belangrijk (max. 3)
er een financiële vergoeding is voor deelnemers.	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>
er directe feedback is op de resultaten die ik verzamel.	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>
ik daarmee mijn baankansen verbeter	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>
ik nieuwe vaardigheden leer, die mijn capaciteiten vergroten.	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>
ik het kan gebruiken om anderen iets te leren.	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>
ik anderen kan helpen.	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>
ik samen met vrienden iets kan doen.	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>
ik bijdraag aan wetenschappelijk onderzoek.	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>
ik bijdraag aan natuurbehoud.	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>
ik nieuwe vaardigheden leer.	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>
ik tijdens het project verschillende vaardigheden combineer.	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>
ik nieuwe dingen leer.	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>
ik nieuwe dingen kan ontdekken.	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>
ik de kans krijg om wetenschappelijk onderzoek te doen.	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>
ik nieuwe sociale contacten kan opdoen.	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>
er een gemeenschap van vrijwilligers is, waar ik dan bij hoor.	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>
deze deelname mijn reputatie verbetert.	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>
ik de taken in dit project zelfstandig uit mag voeren.	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>

Dit is het einde van deel twee. Het laatste deel van de vragenlijst gaat over een smartphone applicatie. We gaan er in de volgende vragen van uit dat u al vrijwilliger bent bij het citizen science project uit deel II. U monitort plantensoorten (ecologie), chemische waterkwaliteit met behulp van strips en waterdiepte doorzicht met behulp van een Secchischijf. Wij (het Zuid-Hollands Landschap) overwegen om een smartphone applicatie in te zetten voor monitoring in het natuurgebied. U krijgt eerst een inleidende tekst te zien. (Let op: het kan even duren voor de handleiding geladen wordt, klik alstublieft niet direct op volgende)

BETREFT: INVOERING SMARTPHONE APPLICATIE

Beste vrijwilliger,

Op dit moment voeren wij een aantal vernieuwingen en innovaties door in ons systeem. We zijn van plan om monitoring voortaan via een smartphone applicatie uit te voeren. U blijft hierbij dezelfde taken doen, alleen nu met behulp van een smartphone. De tellingen van ecologie en de waterdiepte doorzicht kunt u invoeren met behulp van een keuzemenu. De strips waarmee we chemische waterkwaliteit meten hoeft u niet meer zelf af te lezen, dit zal gedaan worden door de app.

Tegelijkertijd met het doosje strips ontvangt u een meetkaartje. U kunt de strip gebruiken en vervolgens op de meetkaart plaatsen. Met één klik maakt u een foto van de kaart. De app leest vervolgens de kleuren af en bepaalt daarmee de concentratie van de stoffen.

Ook kunt u van de omgeving foto's maken. Deze informatie wordt automatisch geüpload naar ons computersysteem, samen met extra informatie zoals datum, tijd en GPS locatie. Zo hebben we alle informatie direct in ons systeem en hoeft u deze niet nog eens thuis in te gaan voeren.

Op de volgende pagina's volgt een handleiding.

Met vriendelijke groeten,

Uw vrijwilligerscoördinator

HANDLEIDING SMARTPHONE APPLICATIE

De applicatie kunt u gratis downloaden vanuit de Apple App Store, Windows Phone App & Games Store of Google Play Store.

1. Download de applicatie



2. Open de applicatie en registreer uzelf.



3. Ga naar uw vaste locatie.

Zorg dat u aan heeft staan:

- de locatie-bepaling (GPS)
- internetverbinding (2G/3G/4G)



4. Open de applicatie.

U kunt nu een keuze maken uit vier opties in het hoofdmenu.



5. Keuzemenu onderwerp

Hier kunt u kiezen welk onderwerp u gaat monitoren: ecologie, chemische kwaliteit of doorzicht.



6. Ecologie

U telt het aantal planten van een soort zoals u al gewend was als vrijwilliger. U kunt deze direct invoeren in de app.



7. Ecologie: foto maken

We vragen u ook een foto te maken van de omgeving. De camera opent automatisch. U maakt de foto met één klik.



8. Ecologie: controle foto

Als u op OK klikt wordt de foto automatisch verstuurd, samen met de door u ingevoerde gegevens en de locatie op basis van GPS.



9. Chemische waterkwaliteit

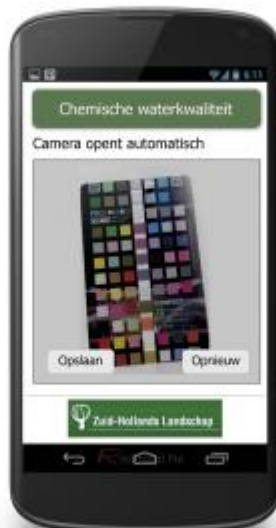
Als u kiest voor chemische waterkwaliteit krijgt u dit scherm te zien. Volgt u de aanwijzingen.

**10. Chemische waterkwaliteit: timer**

De timer telt af van zestig naar nul. Daarna opent de camera automatisch.

**11. Chemische waterkwaliteit: foto**

Klik op opslaan om de foto te versturen. Klik op opnieuw als u een nieuwe foto te maken.

**12. Chemische kwaliteit: feedback**

De app leest de kleuren en vertaalt dit naar een concentratie. U krijgt direct in uw scherm te zien wat de gemeten waarde is.



13. Waterdiepte doorzicht

U kunt de Secchi schijf meenemen naar uw locatie. U volgt dan de instructies op het scherm.



14. Waterdiepte doorzicht: invoer

Na afloop van de meting kunt u deze invoeren in de app. U klikt hoger of lager tot de schijf op de juiste diepte staat.



15. Waterdiepte doorzicht: opslaan

Als u op opslaan klikt wordt de meting automatisch verstuurd. Ook kunt u vanuit dit scherm door naar het bekijken van gegevens op de kaart of terug naar het menu.



16. Bekijk de resultaten

U kunt elke invoer direct op de kaart weergeven. Dit geldt voor uw eigen metingen, maar ook voor die van anderen. Ook kunt u hier de foto's bekijken.



17. Bekijk de resultaten

Door te klikken op een blauwe stip vraagt u de gegevens van een locatie op. De applicatie geeft hier direct feedback op. Hier ziet u ook de resultaten van de afgelopen jaren.

**18. Extra informatie**

Om u van extra informatie te voorzien hebben wij informatie opgenomen over een aantal onderwerpen. Een voorbeeld staat hieronder.



- Einde van de handleiding -

Stel u voor dat u al vrijwilliger bent bij het Zuid-Hollands Landschap. U houdt zich bezig met monitoring van ecologie, chemische waterkwaliteit en waterdiepte doorzicht zoals beschreven in het vorige deel. Bij het beantwoorden van de vragen gaat het om uw mening over het gaan gebruiken van de applicatie. Geef hieronder aan in hoeverre u het eens bent met de volgende stellingen.

Geef hieronder aan in hoeverre u het eens bent met de volgende stellingen.

	Helemaal oneens	Grotendeels oneens	Deels oneens	Neutraal	Deels eens	Grotendeels eens	Helemaal eens
Ik heb de intentie om deze app te downloaden.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ik heb de intentie om deze app te gebruiken bij het verzamelen van gegevens.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Aangenomen dat ik toegang heb tot de app, dan voorspel ik dat ik de app ga gebruiken.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Er zijn op dit moment beperkingen waardoor ik deze app niet zou gebruiken.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Welke beperkingen om deze app te gebruiken voorziet u?

Geef hieronder aan in hoeverre u het eens bent met de volgende stellingen. Het gebruik van deze app:

	Helemaal oneens	Grotendeels oneens	Deels oneens	Neutraal	Deels eens	Grotendeels eens	Helemaal eens
is belangrijk voor de genoemde taken.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
sluit niet aan bij de genoemde taken.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
is relevant voor de genoemde taken.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Helemaal oneens	Grotendeels oneens	Deels oneens	Neutraal	Deels eens	Grotendeels eens	Helemaal eens
Ik verwacht dat het gebruik van deze app voor mij duidelijk en begrijpelijk zal zijn.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ik verwacht dat het gebruik van deze app weinig mentale inspanning vraagt.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Deze app lijkt mij eenvoudig te gebruiken.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Ik verwacht deze app te kunnen gebruiken als:

	Helemaal oneens	Grotendeels oneens	Deels oneens	Neutraal	Deels eens	Grotendeels eens	Helemaal eens
het lijkt op apps waar ik ervaring mee heb.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
iemand het me eerst voordoet.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
er een ingebouwde helpfunctie is voor assistentie.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
er niemand in de buurt is om me te vertellen wat ik moet doen.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Helemaal oneens	Grotendeels oneens	Deels oneens	Neutraal	Deels eens	Grotendeels eens	Helemaal eens
Het gebruik van deze app zal het makkelijker maken om gegevens te verzamelen.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Het gebruik van deze app zal mijn productiviteit verhogen.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ik zou het gebruik van deze app nuttig vinden voor het verzamelen van gegevens.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Ik zou deze app nuttig vinden voor:

- communicatie met anderen
- opzoeken van informatie
- het verzamelen van gegevens
- het doorgeven van gegevens
- anders, namelijk: _____
- geen van bovenstaande

Geef hieronder aan in hoeverre u het eens bent met de volgende stellingen.

	Helemaal oneens	Grotendeels oneens	Deels oneens	Neutraal	Deels eens	Grotendeels eens	Helemaal eens
Ik heb de juiste hulpmiddelen om deze app te gaan gebruiken.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Gezien de hulpmiddelen, kennis en omstandigheden die nodig zijn om deze app te gebruiken, zou het voor mij makkelijk te gebruiken zijn.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Deze app sluit niet aan bij andere systemen die ik gebruik in mijn communicatie met het Zuid-Holland Landschap.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Stel u voor dat u al vrijwilliger bent bij het Zuid-Hollands Landschap. U houdt zich bezig met monitoring van ecologie, chemische waterkwaliteit en waterdiepte doorzicht zoals beschreven in het vorige deel. Bij het beantwoorden van de vragen gaat het om uw mening over het gaan gebruiken van de applicatie. Geef hieronder aan in hoeverre u het eens bent met de volgende stellingen.

	Helemaal oneens	Grotendeels oneens	Deels oneens	Neutraal	Deels eens	Grotendeels eens	Helemaal eens
Ik geloof dat ik de gevolgen van het gebruik van deze app aan anderen zou kunnen uitleggen.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
De voordelen van het gebruiken van deze app voor monitoring zijn duidelijk voor mij.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ik zou het moeilijk vinden om uit te leggen waarom het gebruik van deze app wel of niet gunstig is.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Helemaal oneens	Grotendeels oneens	Deels oneens	Neutraal	Deels eens	Grotendeels eens	Helemaal eens
Mensen om mij heen zullen vinden dat ik deze app moet gebruiken.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mensen die belangrijk voor mij zijn zullen vinden dat ik deze app moet gebruiken.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Geef hieronder aan in hoeverre u het eens bent met de volgende stellingen.

	Helemaal oneens	Grotendeels oneens	Deels oneens	Neutraal	Deels eens	Grotendeels eens	Helemaal eens
Ik denk dat het gebruik van deze app op vrijwillige basis zal gaan.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ik zou mij niet verplicht voelen om deze app te gebruiken.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Alhoewel het nuttig zou kunnen zijn, is het gebruik van deze app niet noodzakelijk om gegevens te verzamelen.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Helemaal oneens	Grotendeels oneens	Deels oneens	Neutraal	Deels eens	Grotendeels eens	Helemaal eens
Mensen die deze app gebruiken zullen meer aandacht krijgen.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Het gebruik van deze app zal een statussymbool worden.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Als mensen deze app gebruiken, dan vindt men hen:

	Helemaal oneens	Grotendeels oneens	Deels oneens	Neutraal	Deels eens	Grotendeels eens	Helemaal eens
Leuk	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Belangrijk	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Interessant	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Helemaal oneens	Grotendeels oneens	Deels oneens	Neutraal	Deels eens	Grotendeels eens	Helemaal eens
Het Zuid-Hollands Landschap kan vertrouwd worden met de gegevens die ik invoer in de applicatie.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ik vertrouw erop dat het Zuid-Hollands Landschap mijn belangen in het oog houdt.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

In de handleiding worden een aantal functies genoemd: Hieronder staan de genoemde functies van de app. Geef voor elk van deze functies of u deze functie belangrijk vindt. Ik vind de functie ____ belangrijk:

	Helemaal oneens	Grotendeels oneens	Deels oneens	Neutraal	Deels eens	Grotendeels eens	Helemaal eens
Invoer van gegevens	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ingebouwde, digitale kaart met alle metingen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Overzicht van de resultaten (alle gegevens over de tijd)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Foto's maken (van de locaties)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Extra informatie	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Hieronder staan een aantal mogelijke extra functies van de app. Geef aan welke extra functies u graag in de app terug ziet komen.

- Een chatfunctie met andere vrijwilligers
- Een functie waarmee ik de foto's en gegevens van anderen kan beoordelen (Zie ik hetzelfde als zij op de foto?)
- Een instructievideo over hoe ik de metingen moet doen.
- Uitleg over wat de meetresultaten betekenen.
- Activiteiten, georganiseerd buiten de app (zie ook de volgende vraag).
- Informatie over andere onderwerpen (zie ook de tweede vraag hieronder).
- Anders, namelijk: _____

Welke extra activiteiten (buiten de applicatie) zou u graag zien?

- Contact met de projectleider.
- Contact met degene die de verzamelde gegevens analyseert.
- Contact met andere vrijwilligers.
- Een trainingsdag.
- Een jaarlijkse bijeenkomst waar de resultaten besproken worden.
- Anders, namelijk: _____

In het algemeen zou ik graag extra informatie ontvangen over:

- Ecologie in mijn omgeving
- De waterkwaliteit in mijn omgeving
- Het overstromingsrisico in mijn omgeving
- De werkzaamheden van het Zuid-Hollands Landschap
- De werkzaamheden van het waterschap
- De werkzaamheden van de TU Delft
- Het genoemde project waarbij natuurgebied gecreëerd wordt
- Anders, namelijk: _____

Op welke wijze zou u graag benaderd willen worden voor een dergelijk project?

- Via de nieuwsbrief.
- Ik wil persoonlijk benaderd worden via de mail.
- Ik wil persoonlijk benaderd worden via de telefoon.
- Ik wil kunnen kiezen uit verschillende projecten.
- Ik wil niet benaderd worden: als ik vrijwilliger wil worden onderneem ik zelf actie.
- Anders, namelijk: _____

U bent bij de laatste pagina met vragen aangekomen.

Deze vragen gaan over het citizen science project. Hieronder vindt u een samenvatting van de informatie tot nu toe: In een natuurgebied bij u in de buurt werken het waterschap en het Zuid-Hollands Landschap samen om agrarisch gebied om te zetten in natuurgebied. Hiervoor nemen zij een aantal maatregelen in het gebied.

U wordt gevraagd om hier vrijwilliger te zijn. Het betreft een citizen science project. U verzamelt hier gegevens over:

- * chemische waterkwaliteit (metingen van de concentratie opgeloste stoffen)
- * doorzicht (de diepte tot waar zonlicht doordringt)
- * ecologie (monitoring van een aantal plantensoorten)

U verzamelt deze gegevens met behulp van een smartphone applicatie. De gegevens zullen gebruikt worden voor het bepalen van de effecten van maatregelen, wetenschappelijk onderzoek en het beheer van het natuurgebied.

De vragen staan op de volgende pagina.

Welke van deze redenen zijn voorziet u waarom u niet mee zou doen aan dit project?

- Ik geloof niet dat de door mij verzamelde data daadwerkelijk gebruikt gaat worden.
- Ik ben niet bereid data te verzamelen voor management doeleinden.
- Ik ervaar een negatieve machtsverhouding tussen mijzelf en het Zuid-Hollands Landschap.
- Ik heb onvoldoende tijd.
- Ik heb er geen vertrouwen in dat ik deze metingen kan doen.
- Het meetproces waarmee gemonitord wordt spreekt mij niet aan.
- Ik ben fysiek niet in staat om mee te doen.
- Anders, namelijk: _____

Welke van onderstaande stellingen gelden voor u?

- Meedoen aan dit project lijkt mij leuk.
- Meedoen kan ik gebruiken om de tijd te doden.
- Ik heb interesse in dit specifieke project.
- Ik doe graag mee, want de omgeving waarin de activiteiten plaatsvinden is prachtig.
- Ik vind het belangrijk dat ik meedoe aan een project dat aansluit bij mijn huidige hobbies.
- Ik ervaar het als mijn verantwoordelijkheid om aan dit project deel te nemen.

Als u de resultaten wil ontvangen van deze studie (in het Engels) en/of beschikbaar bent voor vervolgonderzoek, kunt u hier uw emailadres achterlaten.

Ik wil:

- graag de resultaten van het onderzoek ontvangen.
- benaderd worden voor deelname aan een vervolgonderzoek

Mocht u nog opmerkingen en/of vragen hebben kunt u die hieronder stellen.

U kunt ook met mij contact opnemen via e.minkman@student.tudelft.nl.

Appendix F

Outcomes of the TAM survey pre-test

1 Results of the pre-test with bachelor students

On 1 May 2015 the TAM questionnaire was tested during a lesson on social scientific research methods. A group of 28 bachelor students, following an elective course on research methodology, were presented the questionnaire with introductory tests. They were asked to evaluate the questionnaire. The commentary of the students focussed on the number of questions and the formulation.

2 Review of texts and images

An online evaluation form was spread among acquaintances of the researcher to assess the texts used in the survey. This form included the texts where respondents are asked to volunteer (text 1a), the citizen science project description (text 1b), the announcement to use mobile crowd sensing (MCS, text 2) and the application manual. Participants were asked to assess the clarity, informativeness, readability, ability to enthuse and language of the texts used in the questionnaire. They could chose from a five point scale: very bad, bad, moderate, good, very good.

Sixteen people reviewed the texts and images. Three quarters of them is female and most are in their 20ss although two reviewers were aged 37 and 46.

2.1 Assessment of the texts describing the citizen science project

Text 1a is an introductory text calling for volunteers. Part of this text was copied from the website of Zuid-Hollands Landschap. Text 1b is the description of the citizen science project that acts as context.

In general these texts are reviewed very well. In text 1a no changes were made, because the ratings are fairly positive overall and to keep it authentic and identical to the ZHL text. In text 1b suggestions to reduce the number of pictures of the Secchi disc and rewrite some sentences were changed to enhance the ability to enthuse of the text.

Table. 1 – Evaluation report of text 1.

Criteria	Text 1a				
	--	-	-+	+	++
Clarity	0%	0%	12.5%	75%	12.5%
Informativeness	0%	0%	0%	75%	25%
Readability	0%	0%	25%	50%	25%
Language	0%	0%	6.2%	75%	18.8%
Ability to enthuse	0%	0%	18.8%	62.5%	18.8%

Criteria	Text 1b				
	--	-	-+	+	++
Clarity	0%	0%	0%	75%	25%
Informativeness	0%	0%	0%	56.2%	43.8%
Readability	0%	0%	0%	68.8%	31.2%
Language	0%	0%	0%	75%	25%
Ability to enthuse	0%	0%	31.2%	68.8%	0%

2.2 Assessment of the text introducing the smartphone application

Text 2 is the announcement to use a smartphone. The text was rated moderately positive overall, although the readability could be improved. The text was rewritten taking the suggestions collected via the form into account. Reviewers suggested using more paragraphs and using more informal language. These changes were made.

Table. 2 – Evaluation report of text 2.

Criteria	Text 2				
	--	-	-+	+	++
Clarity	0%	0%	12.5%	75%	12.5%
Informativeness	0%	0%	25%	62.5%	12.5%
Readability	0%	6.3%	12.5%	62.5%	18.8%
Language	0%	0%	12.5%	62.5%	18.8%
Ability to enthuse	0%	0%	56.2%	27.5%	6.3%

2.3 Assessment of the application manual

The manual texts and images were both evaluated. The manual could be improved on readability and ability to enthuse. The readability was improved based on the suggestions of the reviewers. The ability to enthuse could not be improved, but is considered of lesser importance; the main objective of the manual is to be informative and clear, two evaluation criteria that were evaluated rather well.

Table. 3 – Evaluation report of the manual.

Criteria	Text manual				
	--	-	-+	+	++
Clarity	0%	0%	6.6%	46.7%	46.7%
Informativeness	0%	0%	0%	40%	60%
Readability	0%	0%	20%	40%	40%
Language	0%	0%	0%	66.7%	33.3%
Ability to enthuse	0%	6.7%	20%	40%	33.3%

Criteria	Pictures manual				
	--	-	-+	+	++
Clarity	0%	0%	6.7%	60%	33.3%
Informativeness	0%	0%	6.6%	46.7%	46.7%
Logic	0%	0%	13.3%	53.3%	33.3%
Lay-out	0%	0%	13.3%	60%	26.7%

Appendix G

Items Technology Acceptance Model

Construct		Item
Behavioural Intention (BI)	BI1	I have the intention to download this app
	BI2 ¹	I have the intention to use this app to collect data.
	BI3 ¹	Given I had access to the system, I predict that I would use it.
Image (IMG)	IMG1 ¹	People who use this app will have a high profile.
	IMG2 ¹	Using this app will become a status symbol. If people use this app, people will find them:
	IMG3	Fun
	IMG4	Important
	IMG5	Interesting
Perceived External Control (PEC)	PEC1 ¹	I have the resources necessary to use this application.
	PEC2 ¹	Given the resources, knowledge and opportunities it takes to use the application, it would be easy for me to use the application.
	PEC3(R) ¹	The application is not compatible with other systems I use.
Perceived Ease of Use (PEOU)	PEOU1 ¹	I expect that using this application is clear and understandable.
	PEOU2 ¹	I expect that using this application does not require a lot of my mental effort.
	PEOU3 ¹	I think this application is easy to use.
Perceived Usefulness (PU)	PU1 ¹	Using this application will make it easier to collect data.
	PU2 ¹	Using this application will increase my productivity.
	PU3 ¹	I think using the application would be useful in data collection.
Relative Advantage (REL)	REL1 ¹	Using this application is important for the mentioned job-related tasks.
	REL2 ¹	Using this application is relevant for the mentioned job-related tasks.
	REL3(R) ¹	Using this application is pertinent to the mentioned job-related tasks.
Reputation (REP)	REP1 ²	The ZHL is known to be dependable.
	REP2(R) ²	The ZHL has a poor reputation among nature managers.
	REP3 ²	The ZHL has a reputation for dependability.
Result Demonstrability (RES)	RES1 ¹	I believe I could explain the consequences of using this app to others.
	RES2 ¹	The results of using this app for monitoring are clear to me.
	RES3(R)	I would have difficulty explaining why using the system may or may not be beneficial.
Smartphone Anxiety (SA)	SA1(R) ¹	Smartphones do not scare me at all.
	SA2	I know how to download an application from the App Store or Google Play Store and how to open it.
	SA3 ¹	Working with a smartphone makes me nervous.
	SA4 ¹	Smartphones make me feel uncomfortable.
Subjective Norm (SN)	SN1	People who are important to me will think that I should use the app.
	SN2	People that are important to me will think that I should use the app.
Satisfaction of Past Interactions (SPI)	SPI ³	I am satisfied in general with my past interactions with ZHL.
	SPI2 ³	In am satisfied with the products and services I have received from ZHL.
Smartphone Playfulness (SPLAY)	SPLAY1 ¹	How would you characterise yourself when you use smartphones:
	SPLAY2 ¹	Spontaneous
	SPLAY3 ¹	Creative Playful
Smartphone Efficacy (SSE)	SSE1 ¹	I could complete the job using the application...
	SSE2 ¹	...if there were no one around to tell me what to do.
	SSE3 ¹	...if I had just the built-in help facility for assistance.
	SSE4 ¹	...if someone showed me how to do it first. ...if it looks like apps that I have experience with.
Trust in Mobile Communications (TMC)	TMC1 ²	In my opinion, mobile internet is now a robust and safe environment to exchange information.
	TMC2 ²	I am sure that ZHL can be trusted with my information.
Trust (TRU)	TRU1 ³	The ZHL is an organisation that keeps promises and commitments.
	TRU2 ²	The ZHL can be trusted with the data I enter in the application.
	TRU3 ²	I trust ZHL to keep my best interests in mind.

¹ Adopted from Venkatesh & Bala (2008)² Adopted from Carter & Bélanger (2005)³ Adopted from Pavlou (2003)

Appendix H

Sampling P-set and Q-set

1 Sampling strategy P set

Two strategies are applied to ensure a diverse P set. The first strategy is based on water authority characteristics and participants job functions. Three factors were formulated to select seven different water boards. The first distinguishing factor is flood risk (high or low), the second is the conglomerate Randstad (inside or outside) and the third is the age of the water authority (either reformed within the last ten years or longer ago). Within the water board people with a diverse background were interviewed: policy advisors, advisors, fields staff, hydrologists and a politician.

This results of these classifications is presented in four quadrants, see Figure 1. At least one water authority is selected from each quadrant. Figure 1.1 reveals that some of the water boards are incorporated in both the explorative phase as in the Q methodological study. In Q methodology this is not considered to be problematic. Advantageous is that these participants (being participants #18, #20, #21, #22 and #24) were known to have a certain viewpoint and to be willing to contribute to the research.

The second strategy consists of asking participants to name one or two colleagues with a different viewpoint. Participants #24, #25 and #30 were involved via this strategy.

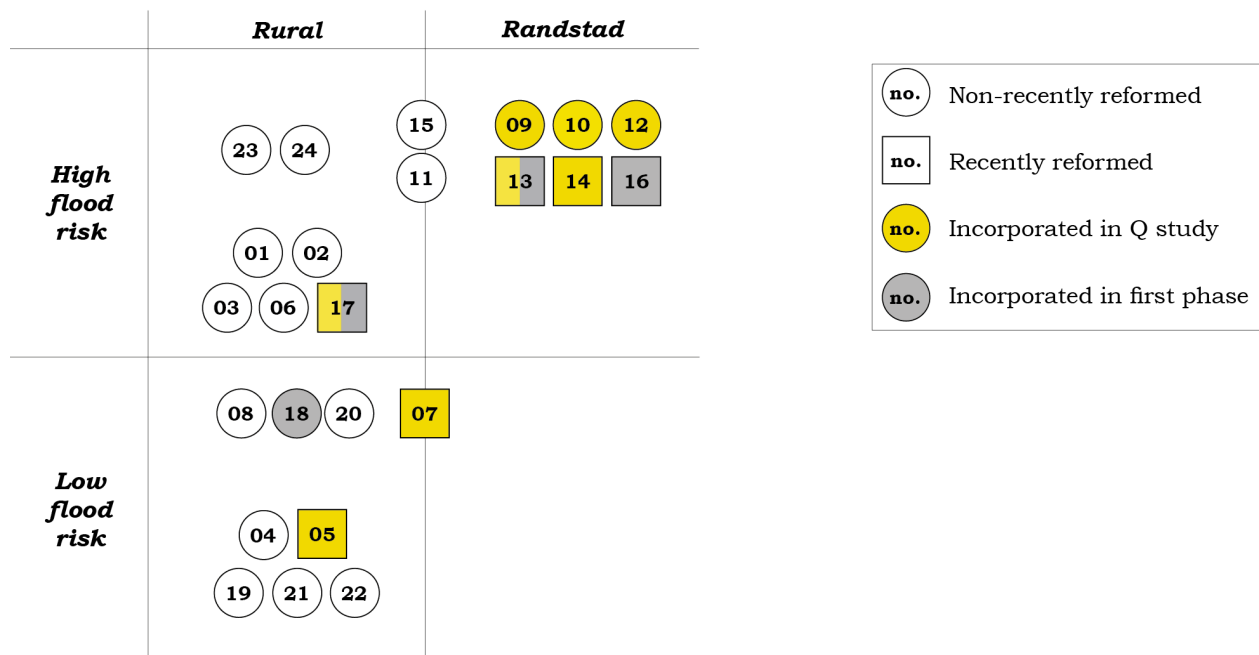


Figure 1 – Classification of the Dutch water authorities. Incorporated factors are flood risk, Randstad and year of the last reform. The numbers correspond to the water authorities shown in figure 2.

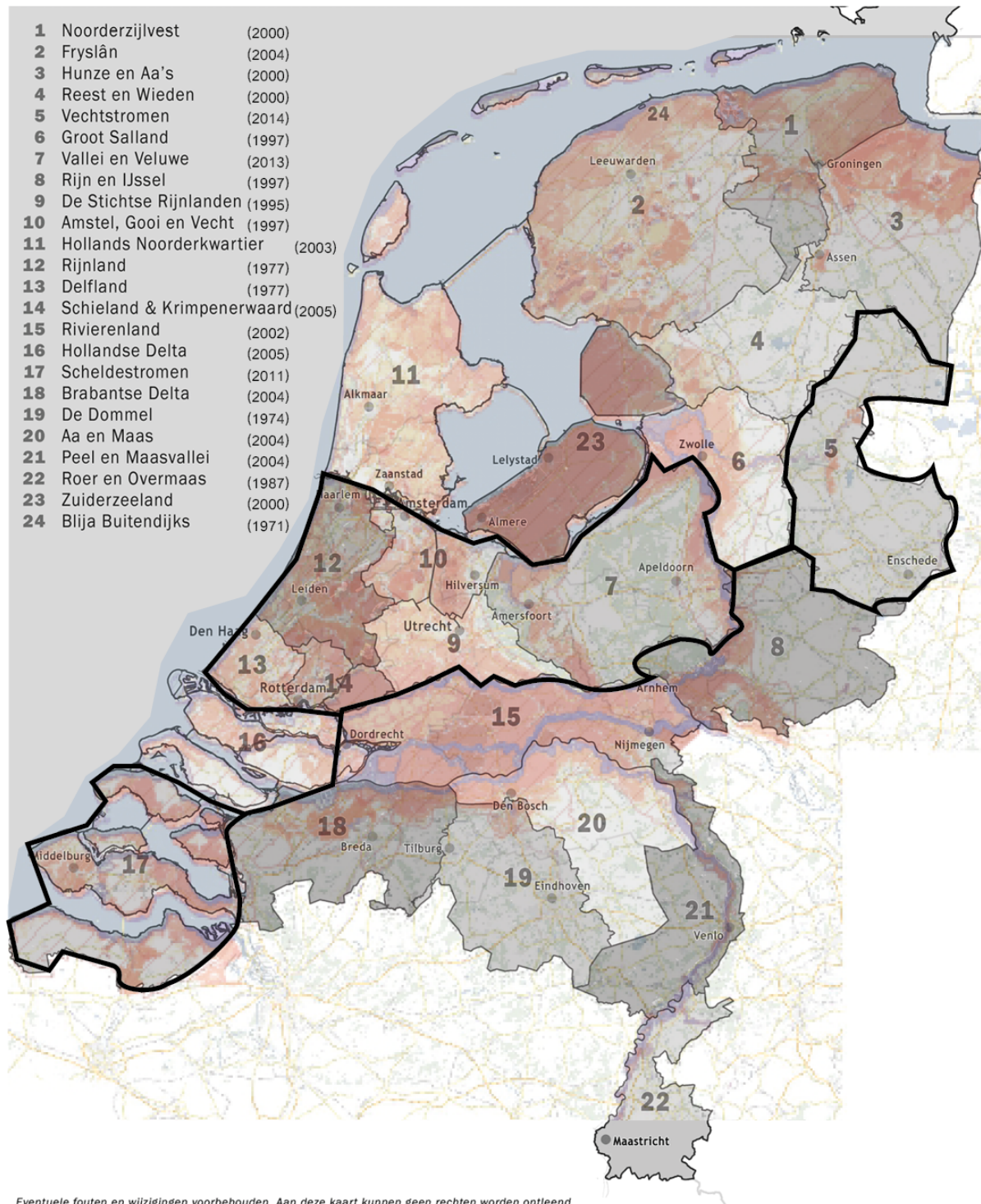


Figure 2 – Map of Dutch water authorities in 2015. The water boards within the black line are included in the Q methodological study. The red areas are areas with a high flood risk. The numbers correspond to a water authority and the year of the last reform of each water authority is indicated in between brackets. The map is based on maps of www.overstromingsrisico.nl and nl.wikipedia.org.

1.1 Participant list

Below the list of participants is shown.

Table 1 – Participant list of the Q methodological study.

Participants reference	Water Authority	Function group	Gender	Date
#1	HHSK	Politician	Female	28-04-15
#2	HHSK	Policy Advisor	Male	29-04-15
#3	HHSK	Policy Advisor	Male	30-04-15
#4	Rijnland	Policy Advisor	Female	01-05-15
#5	Vallei&Veluwe	Policy Advisor	Female	12-05-15
#6	Vallei&Veluwe	Advisor	Male	12-05-15
#7	St. Rijnlanden	Field staff	Male	13-05-15
#8	St. Rijnlanden	Advisor	Female	13-05-15
#9	St. Rijnlanden	Policy Advisor	Female	13-05-15
#10	St. Rijnlanden	Policy Advisor	Male	13-05-15
#11	Vallei&Veluwe	Policy Advisor	Male	26-05-15
#12	Vallei&Veluwe	Policy Advisor	Male	26-05-15
#13	Vallei&Veluwe	Project/Team leader	Male	26-05-15
#14	Vallei&Veluwe	Field staff	Female	28-05-15
#15	Vechtstromen	Policy Advisor	Female	28-05-15
#16	Vechtstromen	Advisor	Female	28-05-15
#17	Vechtstromen	Advisor	Male	28-05-15
#18	Scheldestromen	Policy Advisor	Male	02-06-15
#19	Scheldestromen	Hydrologist	Male	02-06-15
#20	Scheldestromen	Policy Advisor	Male	02-06-15
#21	Scheldestromen	Policy Advisor	Male	02-06-15
#22	Scheldestromen	Hydrologist	Female	02-06-15
#23	Delfland	Innovation advisor	Female	05-06-15
#24	Delfland	Innovation advisor	Male	11-06-15
#25	Delfland	Policy Advisor	Male	12-06-15
#26	Delfland	Advisor	Male	15-06-15
#27	Delfland	Policy Advisor	Male	26-06-15
#28	Waternet	Policy Advisor	Male	01-07-15
#29	Waternet	Project/Team leader	Male	01-07-15
#30	HHSK	Policy Advisor	Male	03-07-15
#31	Rijnland	Advisor	Maile	03-07-15
#32	Rijnland	Policy Advisor	Female	03-07-15
#33	Rijnland	Policy Advisor	Female	03-07-15

2 Sampling strategy Q set

To collect statements a diverse set of sources was accessed. Previous studies on water management, (mobile) crowd sensing and citizen participation formed the theoretical point of view. Policy documents of national authorities were consulted to determine the political dialogue and policy direction. Interviews with water boards and a water company were used to incorporate the view from daily practice on a water quality monitoring level. Additionally a workshop was organised around the specific case of mobile crowd sensing in water quality monitoring. Besides participants from all layers of water boards, also researchers and consultants were present. Individual citizens and representatives of citizen organizations for farmers, sports fishermen and recreational entrepreneurs were asked for their opinion on citizen involvement in water quality monitoring. This was respectively done in a focus group meeting with six members of an informal walking club and in three individual semi-structured interviews. The whole of sources led to a set of 228 statements, which were reduced to a final set of 46.

2.1 Interviews with water authorities and organisations

Interviews were conducted with representatives of four water boards, a drinking water company, two nature managers and three citizen organizations. These organizations represent agricultural entrepreneurs, recreational entrepreneurs and sports fishermen.

The latter three were chosen since these groups of citizens have a high stake in water quality and are actors in the field. The four water boards were chosen in the South-western Delta of the Netherlands. This spatial focus was chosen because of participation to the Delta Water Award. The interviewees of the water boards include water boards that are considered conservative and water boards that are viewed as innovative by anonymous experts in the field. All interviewees were considered experts within their organizations regarding water quality and, if applicable, water quality monitoring.

Topics discussed with the participants included:

- The role of water quality for their organizations' business;
- The current practice of water quality monitoring;
- The current role of citizens within the organisation;
- The interviewee's view on citizen participation within the organisation;
- A case discussion, what do interviewees think of participating in a citizen science project initiated by a water board?

Distinctive remarks made during the interview were incorporated into the Q set of statements.

2.2 Focus group meeting with citizens

A focus group meeting was organised with six people having an interest in nature. Five participants are member of an informal walking group of middle-aged women; the sixth participant is a friend of one of the members with an interest in nature. The walking group gathers every two weeks for a walk of approximately two hours in a nature rich area organised by one of the members. Not all members join every other week, leading to a total group of around 20 people.

The group was not very homogeneous as illustrated above, caused by practical constraints. The meeting had to be organised before early November 2014, being the deadline of the Delta Water Award. Implications for the research are that the group is rather biased, because they come from the same area and have the same interest. On the other hand must be noted that this group hosts a range of backgrounds in terms of ages (47 to 62 years), employment status (employed, unemployed), work field (photography, health care and research), income levels and marital status (married, widowed and divorced). Another point that has to be mentioned is that three women were within the social network of the author, being a parent and two of her family's acquaintances. However, none of them were beforehand informed on the propositions that guided the focus group meeting.

The meeting lasted 1.5 hours and consisted of the following topics after an introduction round and mentioning of the discussion rules:

- Request to mention examples of citizen science;
- Discussion about the statement:
"It is a good development that scientists involve citizens in their work activities, in terms of information collection, data analysis and result interpretation.";
- Request to compose a list answering the question:
"Under what conditions would you be willing to conduct measurements for a nature organisation?";
- Discussion about the statement:
"Authorities (municipalities, provinces and water boards) should make more use of knowledge of citizens in decision making and policy composition.";
- Request to compose a list answering the question:
"Under what conditions would you be willing to conduct measurements for a nature organisation?";
- Case discussion, what do the participants think of the proposed Water Quality Tracker?

The focus group meeting was recorded with permission of the participants. Distinctive statements were taken from the meeting to supplement the Q set.

2.3 Workshop big data en citizen science.

In November 2014 water board Delfland organised a conference around the Fysieke Digitale Delta. Part of the programme was a workshop around citizen science and big data. The author was co-organising and introduced two case studies and acted as facilitator for one of four discussion groups. The presented cases included the proposed mobile crowd sensing application for water quality and MijnVisMaat, an application that allows sports fishermen to share pictures and information of their catches made.

Two topics were added by input from the audience: "How can we get more information from the people and citizens in our area, to create an area wide impression of the water quality?" and a topic focussing on validation.

Approximately 40 water experts participated in the workshop that lasted for about one hour. Most participants were working at a water board, but representatives of universities and research institutes and consultancy firms were present as well. In four groups the topics were discussed, with two groups discussing MijnVisMaat. The following questions were issued as guideline, although groups could choose their own directions:

What data sources come to mind that can be useful for water management?

How could this information be coupled to other information, what would you need for this coupling?

How can these additional data sources be used for water management purposes?

All four summarizing presentations were recorded and the whole discussion of the group that was lead by the author as well. The statements made in the presentation are used to supplement the Q set of statements.

Appendix I

All statements Q methodology

In this appendix the themes identified in all collected statements is presented. Additionally the pre-set of 65 statements is presented. Finally the Dutch statements are presented, together with their English translation.

1 All statements (229)

Statements are divided in 18 categories based on intuition and logic. They are displayed in Table 1. The number in brackets indicates the number of statements per category. In Table 2 the origin of the statements is presented.

Table 2 – The original set of statements, categorised by 18 themes.

	Theme	Number of statements
A.	Motivation citizen	25
B.	Continuity	6
C.	Accuracy	9
D.	Information need	20
E.	Image	9
F.	Challenges	4
G.	Participants	14
H.	Acceptance as a source	25
I.	Compensation	4
J.	Participation and collaboration	39
K.	Automation	13
L.	Tasks	9
M.	Collaboration	11
N.	Education	4
O.	Visibility	8
P.	Organisation	11
Q.	Validation	9
R.	Goals	7

Table 1 – Sources of statements and total count.

Type	Number of statements
Interview Orientation Phase	149
Interview Reference Case	32
Workshop	21
Focus Group	20
Literature	2
Other	5
<i>Total</i>	229

2 Pre-set (65 statements, Dutch only)

These 228 statements are grouped and combined where possible. Statements that did not match the main topic of water quality monitoring and citizen science were excluded. This resulted in a pre-set of 65 statements.

Code	Statement	Related statements:
A12	Waterkwaliteit is te abstract en te moeilijk voor burgers om te begrijpen.	A21 A25
A21	Ik zou niet weten waarom burgers NIET geïnteresseerd zijn in waterkwaliteit.	A12
A3	Deelname aan het project moet het eigenbelang van de deelnemende burger dienen.	
A4	Data verzameling door burgers is niet nauwkeurig genoeg, dat moet je overlaten aan veldmedewerkers van het waterschap of andere specialisten.	C5 C8 G7 H21
A5	De burger is niet te motiveren om voor langere tijd mee te doen aan dit soort projecten.	A25 B1
A8	De burger moet inzicht krijgen in de meest recente gegevens.	
C1	Met een korte training zijn burgers in staat om metingen voor het waterschap te doen.	
C6	<i>We moeten beter leren omgaan met de onnauwkeurigheid van alternatieve (goedkope) metingen.</i>	
C7	De exacte waarde is minder interessant dan de trend die je gaat meten.	
C9	Niet de burger die meet, maar de meetmethode bepaalt de nauwkeurigheid en beperkingen.	
D11	Het waterschap is er niet klaar voor om nieuwe databronnen te gebruiken.	
D18	Wat je aan de burger terugkoppelt staat los van wat je als organisatie met die gegevens doet.	
D19	Citizen Science maakt het mogelijk om metingen ruimtelijk en over tijd groter aan te pakken.	
D6	Ik maak liever (slim) gebruik van metingen die er toch al zijn, dan meer te gaan meten.	D10 D12 D14 H4
D7	Innovatie is alleen mogelijk door constant op zoek te gaan naar nieuwe methoden en toepassingen.	
E4	Waterkwaliteit moet je niet teveel in het openbaar discussiëren, dan worden de verkeerde conclusies getrokken door burgers.	E3 O4
E9	Door citizen science in te zetten laat het waterschap zien dat het met haar tijd meegaat.	
F1	Als burgers structureel iets bijdragen, mogen zij daar in gecompenseerd worden.	
F2	Het scheppen van valse verwachtingen naar mensen toe is de belangrijkste valkuil.	
F4	De grootste uitdaging is hoe je mensen wat kunt leren, als ze er maar heel weinig tijd aan besteden.	
G11	Burgers worden vaak onderschat, ze zijn beter onderlegd en slimmer dan wij	

	denken.				
G12	Je kunt hier een ander deel van je publiek mee aan je binden.	G10	G14		
G3	Niet alle burgers kunnen worden vertrouwd om deze metingen te doen.				
G5	Scholen zijn de meest geschikte doelgroep voor het doen van deze metingen, bijvoorbeeld tijdens een slootles.	G13	N3	N4	
G8	Een burger is geen hydroloog en begrijpt niet wat hij meet.	L4			
G9	De organisatie is niet uitgerust om met grote groepen citizen scientists te werken.				
H13	Nieuwe vormen van meten zie ik wel zitten, maar niet door Jan Publiek.	H9	K5		
H15	Ongestructureerde metingen en waarnemingen van burgers zijn een waardevolle aanvulling op officiële, gestructureerde waarden.	H6	H7	H11	H14
H16	Citizen science is een economische manier van metingen verzamelen.	H23			
H17	Het is geweldig als je door mensen te betrekken aan je gegevens kunt komen.	R4			
H18	Data uit citizen science is een welkome aanvulling, zelfs als het niet wettelijk geaccepteerd wordt.	H19			
H23	De snelheid waarmee mobile crowd sensing data in het systeem staat is een groot voordeel.	H16	K8		
H25	Burgers hebben vaak kennis uit het gebied, die moet het waterschap benutten.				
H5	Het is slechts een kwestie van tijd voordat burgers actief in-situ metingen verrichten.	J11			
H7	(Nieuwe) databronnen waarvan de nauwkeurigheid lager ligt dan die van laboratoriametingen moet het waterschap niet accepteren.	H6	H11	H14	
J12	Burgers die data verzamelen is interessant als sociale innovatie, <u>maar niet om daadwerkelijk geschikte data te verzamelen.</u>				
J16	Als de burger data verzamelt voor het waterschap, moet hij ook inspraak krijgen in de maatregelen die daarna genomen worden.				
J17	We kunnen niet zonder de burger doordat er minder financiële middelen beschikbaar is.				
J20	Citizen Science is nodig, om duidelijk te maken wat je doet als waterschap en waarom.	J22			
J24	Ik zit niet te wachten op burgers die zich met mijn werk gaan bemoeien.				
J29	Citizen science is belangrijk, omdat het helpt om de kloof tussen het waterschap en de burger te verkleinen.				
J33	We moeten meer aandacht besteden aan de problemen waar burgers zich druk om maken.	J34	J37		
J34	Citizen science zorgt er voor dat je je blik kantelt en beter aansluit op wat mensen beleven.	J33			
J39	Citizen science is belangrijk, omdat het een bijdrage levert aan het verhogen van het waterbewustzijn.	H1	H2	O4	
J5	Het waterschap kan haar werkzaamheden niet meer goed uitvoeren zonder de burger te betrekken.				
J8	Het belangrijkste voordeel van citizen science is dat het de kans op weerstand vanuit de burger te verkleinen.				
K9	Alleen nieuwe methoden die geen trendbreuk veroorzaken moeten gebruikt worden.				

L3	Het waterschap moet alle metingen zelf in de hand houden, zij is immers eindverantwoordelijk.				
L4	Veel taken die het waterschap doet, zijn te ingewikkeld om burgers bij te betrekken.	G8			
L8	Het werven en ondersteunen van deelnemers is een te zware belasting.	P9			
L9	Ik vind dat het opzetten van citizen science niet onder de taken van het waterschap valt.				
N2	Het is belangrijk om goed te communiceren waarom waardes afwijken van de norm en wat onzekerheid is.				
P1	Als burgerparticipatie niet in het beleid is opgenomen, moet het waterschap er niet in investeren.	P6			
P4	De behoudendheid van mijn organisatie vormt een belemmering voor burgerwetenschap.	P2	P7	P8	P10
P6	Het waterschap moet in haar beleid kijken hoe ze burgerwetenschap meer kan doen en stimuleren.	P1			
P8	Binnen de organisatie draagvlak creëren voor citizen science is het grootste knelpunt.				
P9	Mijn organisatie heeft geen capaciteit om al die data te verwerken.	L8			
Q2	Je moet burgers een referentiekader bieden, zodat zij zelf hun data kunnen valideren.				
Q3	Data wordt betrouwbaarder als burgers het hogere doel begrijpen.				
Q6	De "wet van de grote getallen" geldt ook voor door burgers verzamelde metingen.				
R1	Het belangrijkste doel van citizen science is mensen iets te leren over hun leefomgeving.				
R2	Het belangrijkste doel van citizen science is dataverzameling.				
R3	Burgers moeten niet verwachten dat hun meting een directe invloed op het beleid heeft.				
R6	Het belangrijkste is dat de gegevens waardevol zijn, als organisatie steek je er tijd en energie in.				
R7	Door meer data uit verschillende bronnen te verzamelen ontdek je onverwachte dingen.				

3 Final set of statements (46)

	Stelling	Statement
1	Burgers inzicht geven in de waterkwaliteit leidt alleen maar tot onnodige paniek en vragen.	Providing citizens with insight in water quality will only lead to unnecessary panic and questions.
2	Citizen Science is belangrijk, omdat het een bijdrage levert aan het verhogen van het waterbewustzijn.	Citizen Science is important, since it contributes to increasing water awareness.
3	Citizen Science is een uitkomst om duidelijk te maken waarom je bepaalde maatregelen neemt als waterschap.	Citizen Science is a resolution to explain why you take certain measures as a water authority.
4	Waterkwaliteit is een abstract begrip, de burger begrijpt dus niet wat hij meet.	Water quality is an abstract concept, citizens will not understand what they measure.
5	Het is belangrijk om goed te communiceren naar de burger waarom waardes afwijken van de norm en wat onzekerheid is.	It is important to have proper communications to citizens about why values deviate from the norm and what the uncertainty in the measured value is.
6	Ik zou niet weten waarom burgers NIET geïnteresseerd zijn in het meten van waterkwaliteit.	I would not know why citizens would not be interested in monitoring water quality.
7	Citizen Science is een economische manier om (extra) metingen te verzamelen.	Citizen Science is an economic way to collect (extra) measurements.
8	Citizen Science maakt het mogelijk om meer metingen te verzamelen door ze frequenter uit te voeren.	Citizen Science enables the collection of more measurements by doing them more frequent.
9	Citizen Science maakt het mogelijk om grote hoeveelheden metingen te verzamelen.	Citizen Science enables the collection of large amounts of measurements.
10	Metingen en waarnemingen van burgers zijn een waardevolle aanvulling op het officiële meetnetwerk.	Measurements and observations by citizens are no valuable addition to the official monitoring network.
11	Het belangrijkste doel is dat de meetgegevens waardevol zijn voor het waterschap, want als organisatie steek je er tijd en energie in.	The most important goal is that the measurement data is valuable for the water authority because time and energy is invested by the organisation.
12	Ik maak liever (slim) gebruik van metingen die er toch al zijn, dan burgers extra metingen te laten doen.	I would rather make (smart) use of existing measurements than letting citizens do more measurements.
13	De grootste uitdaging is hoe je mensen iets kunt leren, als ze er maar heel weinig tijd aan kunnen of willen besteden.	The greatest challenge is how to learn people something, if they can or want to spend little time on it.
14	Met name scholen zijn een geschikte doelgroep voor het doen van deze metingen, bijvoorbeeld tijdens een 'slootles'.	Especially schools are suitable target groups to do these measurements, for example during a 'water lesson'.
15	Het belangrijkste doel van Citizen Science is mensen iets te leren over hun leefomgeving.	The most important goal of citizen science is to learn people something about the environment they live in.
16	Citizen Science is interessant als sociale innovatie, maar niet geschikt om daadwerkelijk bruikbare data te verzamelen.	Citizen Science is an interesting social innovation, but not suitable to actual collect useful data.
17	Burgers worden vaak onderschat, ze zijn beter onderlegd en slimmer dan wij denken.	Citizens are often underestimated, they are better educated and smarter than we think.
18	Als waterschap moeten we leren omgaan met de onnauwkeurigheid van alternatieve (goedkope) metingen uit Citizen Science.	As a water authority we need to learn how to handle the uncertainty of alternative (cheap) measurements that originate from Citizen Science.

	Stelling	Statement
19	Data verzameling door burgers is onnauwkeurig en moet dus niet geaccepteerd worden door het waterschap.	Data collection by citizens is unreliable and should not be accepted by the water authority.
20	Burgers doen alleen mee aan Citizen Science, als die deelname in hun eigen belang is.	Citizens will only participate in Citizen Science, if participation is in their own interest.
21	Niet alle burgers kunnen worden vertrouwd om deze metingen te doen.	Not all citizens can be trusted to do these measurements.
22	Met een korte training zijn burgers in staat om metingen voor het waterschap te doen.	With a short training, citizens will be able to do measurements for the water authority.
23	Citizen Science is een interessante manier om het begrip burgerparticipatie invulling te geven.	Citizen Science is an interesting way to give meaning to the concept of citizen participation.
24	Citizen Science is noodzakelijk, omdat het helpt om de kloof tussen het waterschap en de burger te verkleinen.	Citizen Science is necessary, because it helps to decrease the gap between citizens and the water authority.
25	Door Citizen Science in te zetten laat het waterschap zien dat het met haar tijd meegaat.	By using Citizen Science, the water authority shows that it is keeping pace with the time.
26	Een belangrijk voordeel van Citizen Science is dat het weerstand tegen projecten door burgers verkleint.	An important advantage of Citizen Science is that it reduces the resistance of citizens against projects.
27	Je kunt met Citizen Science een ander deel van je publiek aan je binden en betrekken.	With Citizen Science one can bind and involve another part of the audience.
28	Zolang burgerparticipatie niet van bovenaf in het beleid wordt opgenomen, moet het waterschap er niet in investeren.	As long as Citizen Science is not included in the policy at the top levels, the water authority should not invest in it.
29	Binnen het waterschap draagvlak creëren voor het inzetten van Citizen Science is een groot knelpunt.	It is a major bottleneck to create support within the water authority for the deployment of Citizen Science.
30	Het waterschap heeft baat bij Citizen Science in het uitvoeren van haar werkzaamheden, omdat er minder (financiële) middelen beschikbaar zijn.	The water authority will benefit from using Citizen Science in conducting its tasks, because less (financial) resources are available.
31	Het conservatieve van mijn organisatie vormt een belemmering voor Citizen Science.	The conservative character of my organisation is a major bottleneck for Citizen Science.
32	De organisatie is niet uitgerust om met grote groepen citizen scientists te werken.	The organisation is not equipped to work with large groups of citizen scientists.
33	Mijn organisatie heeft geen capaciteit om al die data te verwerken.	My organisation has no capacity to work with all these data.
34	Het waterschap moet in haar beleid kijken hoe ze Citizen Science meer kan doen en stimuleren.	The water authority should incorporate in its policy how to deploy and stimulate Citizen Science more.
35	Als burgers structureel iets bijdragen, mogen zij daar in gecompenseerd worden.	If citizens are structurally contributing, they shall be compensated for that.

	Stelling	Statement
36	Als de burger data verzamelt voor het waterschap, moet hij ook inspraak krijgen in de maatregelen die daarna genomen worden.	If citizens collect data for the water authority, they should have a say in the measures taken afterwards.
37	Burgers hebben vaak kennis uit het gebied, die moet het waterschap benutten.	Citizens often have local knowledge, the water authority should use this knowledge.
38	Citizen Science is belangrijk, omdat je zo inzicht krijgt in om welke problemen burgers zich druk maken.	Citizen Science is important, because it gives insight into the problems that citizens are concerned with.
39	De burger moet inzicht krijgen in de meest recente gegevens van de waterkwaliteit die het waterschap beschikbaar heeft.	Citizen should have insight in the most recent information of the water quality that is available with the water authority.
40	Als je burgers referentiekader biedt, kunnen zij ook zelf hun data valideren.	If you provide citizens with a reference framework, they themselves can validate their data.
41	Ik zit niet te wachten op burgers die zich met ons werk gaan bemoeien.	I do not want citizens to interfere with our work.
42	Het waterschap moet het doen van metingen zelf in de hand houden, zij is immers eindverantwoordelijk.	The water authority should stay in control of doing the measurements, since the water authority is indeed responsible.
43	Ik vind dat het opzetten van Citizen Science niet onder de taken van het waterschap valt.	I think the creation of Citizen Science does not fall within the tasks of the water authority.
44	Ik kan mij geen goed beeld vormen van water mogelijk is met Citizen Science.	I do not have a full image of what is possible with Citizen Science.
45	Een belangrijke valkuil is dat burgers verwachten dat hun meting een directe invloed op het beleid heeft.	An important caveat is that citizens will expect that their measurement have a direct influence on policy.
46	De burger is niet te motiveren om voor langere tijd mee te doen aan dit soort projecten.	Citizens cannot be motivated to participate in such projects for a longer period.

Appendix J

An introduction to factor extraction

1. A short introduction to the statistics of factor extraction

Letters refer to:

- $F_m(n)$ = factor loading of sort n on factor m
 d = square of the difference between two Q sorts on an item
 s = standard deviation
 m = number of factor
 n = number of Q sort
 N = total number of sorts
 i = number of item
 I = total number of items

1.1. Correlation matrix

One starts by creating an N by I (26 by 46) matrix of all Q sorts and items. The correlation of Q_n to all other Q sorts is calculated using Equation 1. See Table 1 for the full matrix.

$$r = 1 - \left(\frac{\sum d^2}{2N} \right) \quad (\text{Eq. 1})$$

1.2. Unrotated factors

1.2.1. How many factors?

- A factor is included when at least two sorts, but preferably three or more sorts have a significant factor loading on this factor. (Watts & Stenner 2012, p. 131; Brown 198 p. 293) This is because with only one Q sort, it is impossible to distinguish c (communal) and s (specific) (Brown 198 p. 293).
- Based on the criteria C to F two or four factors should be extracted. When criterion A and B are taken into account five to seven would be acceptable as well. The analysis will be continued with five factors.

A. The magic number 7

For a rough estimate, one can use the number seven (Watts & Stenner 2012, p. 106; Brown 198 p. 223). Usually there are not more than seven factors to be extracted.

B. A factor for each 6 to 8 participants

Extracting a factor for every six or eight participants is a rule of thumb that cannot be mathematically justified, but is convenient in practice and seems to be applicable (Watts & Stenner 2012, p. 107). For this study, with 30-35 participants, that would suggest using 5 factors, although 4 or 6 would be defensible as well according to this rule of thumb.

1. Kaiser-Gutmann Criterion: Eigenvalues > 1

A more mathematical criterion is the Kaiser-Gutmann criterion, which states that only factors with an eigenvalue (EV) above 1.00 should be included. Factors with an EV below 1.00 account for less variance than a single Q sort (Watts & Stenner 2012, p.106). Eq. 2 shows how to calculate the EV of factor m . Two factors have an eigenvalue above 1. Although factor C has an eigenvalue close to 1 (0.96), so this factor will be interesting to include as well.

$$EV_m = \sum (F_m(n))^2 \quad \text{or} \quad EV_m = Var_m \cdot \left(\frac{N}{100} \right) \quad (\text{Eq. 2})$$

Table 1 – Correlation matrix showing correlations $r_{n,n}$ (decimals to two places omitted).

1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
1	-	36	32	52	44	63	48	25	71	04	36	52	47	53	66	58	40	14	59	20	66	58	59	54	24	61	66	29	22	37	11	55	64
2	36	-	32	17	40	39	30	45	49	12	32	49	31	48	49	52	44	39	36	40	32	36	53	29	24	28	46	28	37	13	29	53	42
3	32	32	-	53	34	36	43	44	39	21	26	52	34	14	37	37	20	30	24	44	26	37	33	27	-01	17	43	52	30	18	27	32	29
4	52	17	53	-	21	49	44	35	43	07	30	40	28	26	38	33	06	16	33	22	45	30	51	29	18	41	56	49	23	28	26	43	29
5	44	40	34	21	-	52	37	44	50	10	40	70	67	63	64	59	41	-07	53	16	52	31	57	48	44	59	66	49	34	09	34	57	68
6	63	39	36	49	52	-	47	36	55	26	41	68	41	64	54	51	15	48	24	71	43	60	47	34	60	74	51	43	19	24	54	68	
7	48	30	43	44	37	47	-	48	55	35	06	41	32	30	39	65	24	30	33	43	31	45	48	34	22	45	49	39	13	44	28	46	31
8	25	45	44	35	44	36	48	-	44	29	07	55	24	32	36	56	31	22	38	19	26	12	37	11	25	25	36	52	08	26	42	39	25
9	71	49	39	43	50	55	55	44	-	06	42	56	59	48	68	63	58	10	61	20	53	49	73	59	39	70	70	52	37	33	14	57	57
10	04	12	21	07	10	26	35	29	06	-	-09	31	-16	24	17	40	15	30	09	-02	27	17	-06	-18	14	-04	17	24	18	07	33	-02	16
11	36	32	26	30	40	41	06	07	42	-09	-	53	50	47	60	32	32	-11	40	16	53	29	56	49	25	54	58	47	30	-02	24	60	45
12	52	49	52	40	70	68	41	55	56	31	53	-	49	62	80	64	55	01	63	31	72	43	52	45	45	53	72	62	41	22	40	66	75
13	47	31	34	28	67	41	32	24	59	-16	50	49	-	48	64	49	38	-17	41	28	40	51	73	66	40	59	58	17	20	25	67	55	55
14	53	48	14	26	63	64	30	32	48	24	47	62	48	-	72	64	47	17	55	19	75	47	63	53	36	43	72	33	28	16	41	65	75
15	66	49	37	38	64	68	39	36	68	17	60	80	64	72	-	66	53	-03	58	18	78	52	67	64	41	55	76	52	36	14	39	75	79
16	58	52	37	33	59	54	65	56	63	40	32	64	49	64	66	-	49	20	49	20	56	46	60	50	34	49	68	25	32	50	63	63	49
17	40	44	20	06	41	51	24	31	58	15	32	55	38	47	53	49	-	18	57	17	44	40	55	41	39	44	49	26	33	26	07	38	66
18	14	39	30	16	-07	15	30	28	10	30	-11	01	-17	17	-03	20	18	-	13	30	-02	23	09	-06	06	-10	13	05	02	20	18	01	02
19	59	36	24	33	53	48	33	39	61	09	40	63	41	55	58	49	57	13	-	24	56	43	52	44	40	66	64	29	22	26	19	46	64
20	20	40	44	22	16	24	43	20	20	-02	16	31	28	19	18	20	17	30	24	-	11	33	29	37	05	17	31	05	-01	29	14	40	14
21	66	32	26	45	52	71	31	26	53	27	53	72	40	75	52	56	44	-02	56	11	-	45	49	50	28	49	75	40	43	14	34	56	75
22	58	36	37	30	31	43	45	18	49	17	29	43	51	47	52	46	40	23	43	33	45	-	49	39	32	34	57	16	25	43	22	46	51
23	59	53	33	51	57	60	48	40	73	-06	56	52	73	63	67	60	55	09	52	29	49	49	-	60	40	66	71	48	25	29	25	71	61
24	54	29	27	29	48	47	34	17	59	-18	49	45	66	53	64	50	41	-06	44	37	50	39	60	-	28	58	57	41	20	28	28	69	52
25	24	24	-01	18	44	34	22	25	39	14	25	45	40	36	41	34	39	06	40	05	28	32	40	28	-	46	46	29	27	24	32	40	50
26	61	28	17	41	59	60	45	30	70	-04	54	53	59	43	55	49	44	-10	66	17	49	34	66	58	44	-	63	47	34	18	21	59	53
27	66	46	43	56	66	74	49	36	70	17	58	72	58	72	76	68	49	13	64	31	75	57	71	57	46	63	-	66	36	28	24	68	74
28	29	28	52	49	49	51	39	53	52	24	47	62	39	33	52	60	26	05	29	05	40	16	48	41	46	47	66	-	34	21	32	47	35
29	22	37	30	23	34	43	13	08	37	18	30	41	17	28	36	24	33	02	22	-01	43	25	25	20	29	34	36	34	-	-01	27	16	37
30	37	13	18	28	09	19	44	26	33	07	-02	22	20	16	14	33	26	20	26	29	14	43	29	28	27	18	28	21	-01	-	02	28	10
31	11	29	27	26	34	24	28	42	14	33	24	40	25	41	39	49	07	18	19	14	34	22	25	28	24	21	24	32	27	02	-	48	24
32	55	53	32	43	57	54	46	39	57	-02	60	66	67	65	75	64	38	01	46	40	56	46	71	69	32	59	68	47	16	28	48	-	60
33	64	42	29	29	68	68	31	25	57	16	45	75	55	75	79	61	66	02	64	14	75	51	61	52	40	53	74	35	37	10	24	60	-

C. Significant factor loading: threshold

Only (unrotated) factors that have two or more significant factor loadings (SFL) are included (Watts & Stenner 2012, p. 107). SFL is calculated with Eq. 3. In this study the SFL is 0.38 resulting in three factors.

$$SFL = 2.58 \cdot \left(\frac{1}{\sqrt{I}}\right) = 2.58 \cdot \left(\frac{1}{\sqrt{46}}\right) = 0.380 \quad (\text{Eq. 3})$$

D. Humphrey's rule

According to Humphrey's rules a factor is significant if the product of the absolute highest factor loadings exceeds twice the standard error (Brown 198 p. 223). The standard error is calculated by and thus is the required factor loading in this study 0.295, resulting in three factors.

$$\sigma = \frac{1}{\sqrt{I}} = \frac{1}{\sqrt{46}} = 0.147 \quad (\text{Eq. 4})$$

E. Scree test

When a Principle Component Analysis (PCA) is performed, one can plot the EVs of the factors in a line plot. When the slope of the plot changes shape, the factors after this twist should be excluded. In this study that means two factors should be extracted, see Figure 1.

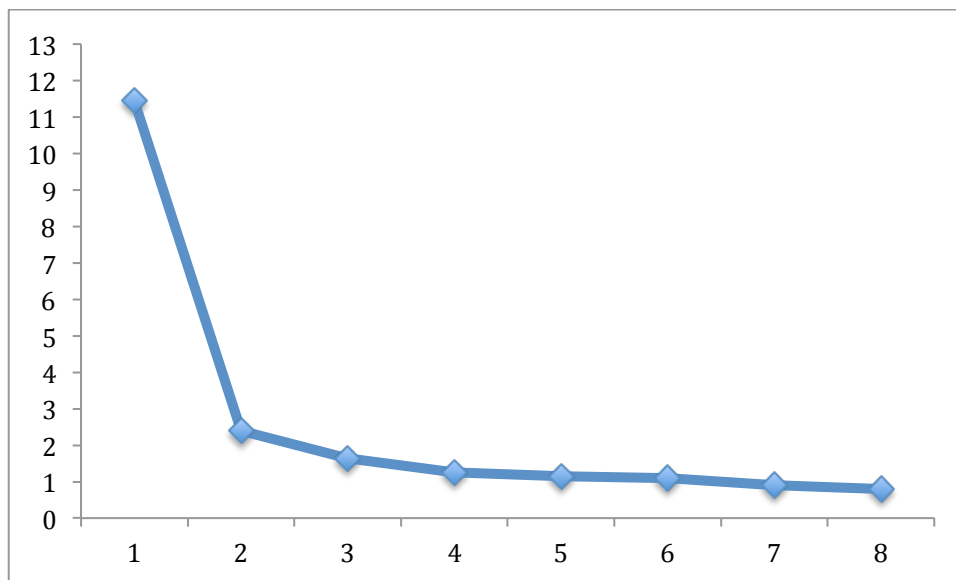


Figure 1 – Scree test for unrotated factors using PCA.

F. Parallel analysis

Parallel analysis makes use of the assumption that there are in fact no factors present in the dataset. It shows what the first, second, etc. factor EV would look like if that is the case. This is done by extracting eigenvalues from random datasets with a similar number of items (cases) and number of participants (variables) (Watts & Stenner 2012, p. 109). This analysis was not performed for this study.

1.2.2. Extracting factor A

The unrotated factors are extracted from the correlation matrix. All example calculations concern Q sort 1, expressed in column 1.

First all correlations for one person are summed: Σr .

$$\begin{aligned} \Sigma r_n &= \Sigma r_{n,m} \\ \Sigma r_1 &= \Sigma r_{1,m} = () + 0.63 + 0.39 + \dots + 0.54 + 0.68 = 14.26 \end{aligned} \quad (\text{Eq. 5})$$

The average \bar{r} is given below.

$$\begin{aligned} \bar{r}_n &= \Sigma r / (N - 1) \\ \bar{r}_1 &= \Sigma r_1 / 32 = 0.45 \end{aligned} \quad (\text{Eq. 6})$$

Next $t_{1,i}$ can be calculated, by adding Σr_i and \bar{r} . The sum of all $t_{1,i}$ is T_1 result is displayed in Table 2. The factor estimate for Q1 is subsequently calculated by dividing $t_{1,i}$ by the square root of T_1 . The first factor estimate for Q1 on factor A becomes 0.77.

$$\begin{aligned} t_{1,n} &= \Sigma r_n + \bar{r}_1 \\ t_{1,1} &= \Sigma r_1 + \bar{r}_1 = 14.26 + 0.45 = 14.70 \quad * \end{aligned} \quad (\text{Eq. 7})$$

*(due to truncation)

$$\begin{aligned} f_{1,n} &= t_{1,n} / \sqrt{T_1} \\ f_{1,1} &= \frac{t_{1,1}}{\sqrt{T_1}} = \frac{15.74}{20.49} = 0,77 \end{aligned} \quad (\text{Eq. 8})$$

However, this f represents only the initial factor estimate. If the $f_{1,i}^2$ deviates too much (± 0.02) from \bar{r} an iteration needs to take place. As can be seen in Table 2 this is the case for the initial estimate f_1 . Iteration takes place by replacing \bar{r} by f_1 in the factor calculation. This is repeated until the difference between f^2 and \bar{r} is below 0.002. As can be seen in Table 2 the factor estimates do not change between the first and second iteration step.

$$\begin{aligned} t_{2,n} &= \Sigma r_n + f_{(1)1,n}^2 \\ t_{2,1} &= \Sigma r_1 + f_{(1)1,1}^2 = 14.26 + 0.52 = 14.77 \quad * \end{aligned} \quad (\text{Eq. 9})$$

*(difference due to truncation)

1.1.1. Extracting factor B and further

The extraction of the other factors is similar to that of factor A. The main difference is that it makes use of the residual correlation matrix. This residual correlation is obtained by subtracting the cross product of factor estimates for each pair from the original correlation. Doing so the correlation accounted for by factor A is removed.

$$\begin{aligned} r_{r\ n,m} &= r_{n,m} - f_{(3)n,m} \cdot f_{(3)n,m} \\ r_{r\ 1,4} &= r_{1,4} - (f_{(3)1,1} \cdot f_{(3)1,4}) = 0.52 - (0.72 \cdot 0.53) = 0.13 \end{aligned} \quad (\text{Eq. 10})$$

The procedure of extracting factor estimates and correcting via iteration is repeated. The same applies for extracting factor C, where the residual correlation of B is used. This way as many factors as desired can be extracted.

Table 2 – Extraction of factor A (decimals to the second place are omitted).

r	1	2	3	4	5	...	29	30	31	32	33	FactorA
1	-	36	32	52	44	...	22	37	11	55	64	72
2	36	-	32	17	40	...	37	13	29	53	42	59
3	32	32	-	53	34	...	30	18	27	32	29	51
4	52	17	53	-	21	...	23	28	26	43	29	53
5	44	40	34	21	-	...	34	09	34	57	68	71
...
29	22	37	30	23	34	...	-	-01	27	16	37	
30	37	13	18	28	09	...	-01	-	02	28	10	35
31	11	29	27	26	34	...	27	02	-	48	24	46
32	55	53	32	43	57	...	16	28	48	-	60	79
33	64	42	29	29	68	...	37	10	24	60	-	77
Σr	1426	1169	122	162	1405	...	833	705	918	1552	1534	
r	45	37	32	33	44	...	26	22	29	48	48	
...												
t1	1470	1205	154	195	1448	...	859	728	946	1600	1582	T1 41969
f(1)	72	59	51	53	71	...	42	36	46	78	77	√T1 249
f(1)^2	52	35	26	29	50	...	18	13	21	61	60	f1 t1/√T1
f(1)^2-r	07	-02	-05	-05	06	...	-08	-09	-07	13	12	
t2	1477	1204	148	191	1455	...	851	718	939	1613	1593	T2 4269
f(2)	72	59	51	53	71	...	41	35	46	79	78	√T2 251
f(2)^2	52	34	26	28	50	...	17	12	21	62	60	f2 t1/√T1
f(2)^2-f(1)^2	00	00	00	00	00	...	00	00	00	01	01	
t3	1478	1203	148	190	1455	...	850	718	939	1614	1594	T3 4277
f3	72	59	51	53	71	...	41	35	46	79	78	√T3 251
f3^2	52	34	26	28	50	...	17	12	21	62	60	f3 t1/√T1
f3^2-f2^2	00	00	00	00	00	...	00	00	00	00	00	

Appendix K

Factor rotation

1 Rotations performed

Two types of rotations were performed: a Varimax rotation (automatic rotation with PQ method) and manual rotations.

The Varimax rotation is performed and three types of manual rotations. There was a manual rotation looking for a best fit, a manual rotation optimising certain sorts, which seemed distinguishing and a manual rotation of the Varimax.

It was also considered to leave out sorts that load significantly on multiple factors (Brown ???). However, in this case that would mean leaving out more than five sorts in all cases. That is considered too many, therefore this has not been applied.

Correlation matrix

For each rotation a correlation matrix for the correlation between the factors is provided as well. Lower correlations between factors are preferred, because it means there is less influence from one factor on another (Watts & Stenner 2012). An overview of the correlations for each rotation is found in Table 1.

1.1. Varimax

I) Varimax with three factors

Varimax is a mathematical optimisation of the overall factor loadings and so maximising total variance explained. This means that the overall solution is optimised and not individual sorts. Such an approach has its advantages: Varimax rotations are considered to be objective and consistent (Watts & Stenner 2012, p. 127) However, Varimax cannot take additional considerations into account.

The Varimax rotation is performed with PQMethod on the three extracted factors.

1.2. Manual rotation

II) Manual: manual rotation of the Varimax (3 factors)

Summary of rotations:

- Factors 1 and 2 were rotated $+15^{\circ}$;
- Factors 1 and 3 were rotated -1° ;
- Factors 2 and 3 were rotated $+4^{\circ}$.

Comparing the original and re-rotated Varimax it seems that indeed some improvements were made. The correlation between the factors decreased and there are less sorts that load on multiple factors. In the original Varimax Q16 loaded on all three factors and eight sorts loaded on two factors, compared to four in the re-rotated Varimax.

Comparing this factor loadings to the 'best fit' rotation, it must be concluded this rotation is not the best option. The factors correlate less in the best-fit rotation and although there are more (five) sorts loading on two factors, the overall fit seems better. For example sort 26.

III) Manual: looking for a 'best fit' (3 factors are extracted)

After a few series of trial and error a 'best fit' was reached. When comparing the factor correlation matrix, it becomes evident that this manual rotation is preferred above the Varimax rotation, but it has similar loadings to the manually re-rotated Varimax.

Summary of rotation steps:

- a) Invert factor 2 (rotate axis 2 with 180°)
- b) Rotate factor 1 and 2 -15°
- c) Rotate factor 2 and 3 -15°
- d) Rotate factor 1 and 3 -13°

IV) Manual: optimising distinguishing sorts (3 factors)

Some sorts looked like they were an exaggeration of previous sorts, for example because the high ranked statements focussed on one topic only. These are expected to represent high factor loadings and thus will be rotated until their maximal loadings. Four sorts were selected for optimisation. These are Q10, Q13, Q30 and Q31.

While optimising these sorts, an eye should be kept on sorts that felt 'odd' as well. However, that does not mean these sorts necessarily will have high factor loadings as well. These sorts are Q12, Q17, Q20, Q27 and Q29.

Summary of rotation steps:

- a) Invert factor 2 (rotate axis 2 with 180°)
- b) Rotate factor 1 and 2 -25°
- c) Rotate factor 2 and 3 -38°

Reflection on the 'remarkable' sorts

1. Sort Q10 has the highest loading on C and negligible loadings on factors A and B.
2. Sort Q13 has a high loading on factor A, but low loadings on factor B and C.
3. Sort Q30 happens to be one of the two sorts in factor B that load significantly on B and far from significant on A and C. The only other sort is Q20.
4. Sort Q31 is the only sort in factor C that has a significant loading on factor C without (near) significant loadings on other factors.
5. Sort Q12 has a high loading on factor A and a quite high one factor C as well. However, it is not unique in this (see sorts Q16).
6. Sort Q17 does not stand out after rotation.
7. Sort Q27 loads very high on factor A (0.83).
8. Sorts Q29 will not have a significant loading on any factor.

Since the factors correlate more in this rotation compared to III, rotation II will not be preferred above 'best fit' (III) or Varimax re-rotation (II).

2 Final factor composition

The two best options are the 'best fit' rotation and the Varimax re-rotation, the resulting factor arrays are in fact the same. The 'best-fit' rotation is chosen, because it has the more extreme values (see Z-values in table 2) and because it has lower factor correlations.

Choosing Significant Factor Loading over Humphrey's rule

As described in Appendix J Humphrey's rule accepts factor loadings above 0.295, while the Significant Factor Loading (SFL) is 0.38. Using Humphrey's rule would result in more Q sorts contributing to the final factor arrays, although they would have a lower factor contribution and most likely have relatively high loadings on other factors as well. This may lead to a higher correlation between the factors and thus a less clear image of the different viewpoints. Therefore SFL will be used, meaning only factor loadings above 0.38 are used to construct the final factor arrays.

Table 1 – Overview of factor correlations, based on the five rotation types performed.

Table 2 – Factor arrays of chosen rotation (III).

I. Varimax rotation (3 factors).

II.	A	B	C
A	1,00	0,63	0,41
B	0,63	1,00	0,51
C	0,41	0,51	1,00

II. Re-rotation of Varimax.

III.	A	B	C
A	1,00	0,35	0,41
B	0,35	1,00	0,42
C	0,41	0,42	1,00

III. Best fit with manual rotation.

IV.	A	B	C
A	1,00	0,26	0,43
B	0,26	1,00	0,35
C	0,43	0,35	1,00

IV. Rotation with chosen sorts.

V.	A	B	C
A	1,00	0,37	0,45
B	0,37	1,00	0,45
C	0,45	0,45	1,00

Item	Factor A		Factor B		Factor C	
	z-score	Score	Z score	Score	z-score	Score
1	-1,60	-3	-1,71	-4	0,01	-4
2	2,08	4	1,88	4	0,03	4
3	0,41	1	-0,53	-1	0,01	-1
4	-0,76	-1	-1,08	-2	0,01	-3
5	0,38	1	0,14	0	0,02	1
6	-0,36	-1	-1,12	-2	0,02	0
7	0,50	1	0,21	1	0,01	-1
8	1,13	3	1,54	3	0,02	1
9	1,56	4	0,91	2	0,02	0
10	-1,88	-4	-1,08	-2	0,01	-1
11	0,36	0	0,48	1	0,02	1
12	-0,92	-1	0,18	0	0,02	0
13	0,00	0	-0,09	0	0,01	-1
14	0,37	0	-0,19	0	0,02	2
15	0,78	1	1,28	2	0,02	3
16	-1,33	-2	-0,77	-2	0,02	0
17	0,57	1	0,40	1	0,02	0
18	0,90	2	0,59	1	0,02	1
19	-1,75	-3	-0,98	-2	0,01	-1
20	-0,16	0	1,37	2	0,01	-2
21	-0,27	-1	0,71	1	0,02	0
22	0,98	2	0,70	1	0,02	2
23	1,50	3	0,43	1	0,03	3
24	1,03	2	-1,23	-3	0,02	2
25	0,66	1	-0,30	-1	0,02	0
26	0,18	0	-0,25	0	0,02	1
27	1,10	2	0,18	0	0,02	3
28	-1,40	-3	-1,12	-3	0,01	-2
29	-0,63	-1	-0,24	0	0,01	-1
30	0,28	0	-0,58	-1	0,02	0
31	-0,22	-1	-0,29	-1	0,01	-2
32	0,09	0	1,47	3	0,02	0
33	-1,02	-2	-0,69	-1	0,01	-2
34	0,82	2	-0,36	-1	0,02	1
35	0,22	0	0,01	0	0,02	0
36	-0,95	-2	-2,51	-4	0,01	-3
37	1,53	3	1,80	4	0,03	4
38	0,73	1	-0,27	0	0,02	1
39	0,71	1	0,35	1	0,02	2
40	0,01	0	-1,58	-3	0,01	-3
41	-1,93	-4	-0,74	-1	0,00	-4
42	-1,08	-2	1,60	3	0,02	2
43	-1,20	-2	-0,75	-1	0,01	-2
44	-0,64	-1	0,13	0	0,01	-1
45	0,04	0	0,94	2	0,02	1
46	-0,82	-1	1,17	2	0,01	-1

Appendix L

Crib sheet

1 Factor interpretation

1.1 Crib sheets

The distinguishing items were defined for each factor. A crib sheet as developed by Watts and described by Watts & Stenner (2012, p. 150) was used for this purpose. The script sheet was adjusted by adding items (see below). In the remainder of this chapter the story lines of each viewpoint are given.

The original sheet consists of the categories:

- 'Items ranked at +4',
- 'Items ranked at -4',
- 'Items ranked higher than in any other factor'
- 'Items ranked lower than in any other factor'

Two categories are added to the original sheet: 'Items ranked equally to factor X, but higher/lower than factor Y.' This was done to check whether there is a high overlap between factors A and C and B and C.

Factor C was included, despite its eigenvalue below 1.00. During extraction it initially seemed that factor C in fact represents a mixture of factors A and B, rather than a viewpoint on it's own. There is quite some overlap between the factors. However, as can be seen in Table 1, factor C is not performing less than the other two factors and it can thus be concluded that including factor C was the right decision.

Table 1 – Overlap between distinguishing items. For example in six items where C has the highest score, these items scored equally high in B. The numbers in the diagonals (e.g. A-A) represent the number of unique distinguishing items for factors A, B or C.

	Highest or Equally high			Lowest or Equally low		
	A	B	C	A	B	C
A	7	-	-	9	-	-
B	5	10	-	5	11	-
C	6	3	10	7	4	7

2 Full crib sheets for all factors

In the following sections the full crib sheets are presented.

2.1 Crib sheet Factor A

Items ranked +4

- 2** Citizen Science is important, since it contributes to increasing water awareness.
- 9** Citizen Science enables the collection of large amounts of measurements.

Items ranked higher in factor A than in any other factor

- 3** Citizen science is a resolution to explain why you take certain measures as water authority. **(1)**
- 4** Water quality is an abstract concept, citizens will not understand what they measure. **(-1)**
- 9** Citizen Science enables the collection of large amounts of measurements. **(+4)**
- 18** As a water authority we need to learn how to handle the uncertainty of alternative (cheap) measurements that originate from Citizen Science. **(2)**
- 25** By using Citizen Science, the water board shows that it is keeping pace with the time. **(1)**
- 34** The water board should incorporate in its policy how to deploy and stimulate Citizen Science more. **(2)**
- 40** If you provide citizens with a reference framework, they themselves can validate their data. **(0)**

Equally high as factor B, higher than C.

- 7** *Citizen Science is an economic way to collect (extra) measurements. (1)*
- 8** *Citizen Science enables the collection of more measurements by doing them more frequent. (3)*
- 13** *I would rather make (smart) use of existing measurements than letting citizens do more measurements. (0)*
- 17** *Citizens are often underestimated, they are better educated and smarter than we think. (1)*
- 31** *The conservative character of my organisation is a major bottleneck for Citizen Science. (-1)*

Equally high as factor C, higher than B.

- 5** *It is important to have proper communications to citizens about why values deviate from the norm and what the uncertainty in the measured value is. (1)*
- 22** *Not all citizens can be trusted to do these measurements. (2)*
- 23** *Citizen Science is an interesting way to give meaning to the concept of citizen participation. (3)*
- 24** *Citizen Science is necessary, because it helps to decrease the gap between citizens and the water board. (2)*
- 30** *The water board will benefit from using Citizen Science in conducting its tasks, because less (financial) resources are available. (0)*
- 38** *Citizen Science is important, because it gives insight into the problems that citizens are concerned with. (1)*

Items ranked lower in factor A than in any other factor

- 10** Measurements and observations by citizens are no valuable addition to the official monitoring network. **(-4)**
- 11** The most important goal is that the measurement data is valuable for the water authority because time and energy is invested by the organisation. **(0)**
- 12** I would rather make (smart) use of existing measurements than letting citizens do more measurements. **(-1)**
- 15** The most important goal of citizen science is to learn people something about the environment they live in. **(1)**
- 19** Data collection by citizens is unreliable and should not be accepted by the water authority. **(-3)**
- 21** Not all citizens can be trusted to do these measurements. **(-1)**
- 42** The water authority should stay in control of doing the measurements, since the water authority is indeed responsible. **(-2)**
- 45** An important caveat is that citizens will expect that their measurement have a direct influence on policy. **(0)**

Equally low as factor B, lower than C.

- 14** *Especially schools are suitable target groups to do these measurements, for example during a 'water lesson'. **(0)***
- 16** *Citizen Science is an interesting social innovation, but not suitable to actual collect useful data. **(-2)***
- 26** *An important advantage of Citizen Science is that it reduces the resistance of citizens against projects. **(0)***
- 28** *As long as Citizen Science is not included in the policy at the top levels, the water authority should not invest in it. **(-3)***
- 39** *Citizen should have insight in the most recent information of the water quality that is available with the water authority. **(1)***

Equally low as factor C, lower than B.

- 29** *It is a major bottleneck to create support within the water authority for the deployment of Citizen Science. **(-1)***
- 32** *The organisation is not equipped to work with large groups of citizen scientists. **(0)***
- 33** *The organisation is not equipped to work with large groups of citizen scientists. **(-2)***
- 41** *I do not want citizens to interfere with our work. **(-4)***
- 43** *I think the creation of Citizen Science does not fall within the tasks of the water authority. **(-2)***
- 44** *I do not have a full image of what is possible with Citizen Science. **(-1)***
- 46** *Citizens cannot be motivated to participate in such projects for a longer period. **(-1)***

Items ranked -4

- 10** Measurements and observations by citizens are a valuable addition to the official monitoring network.
- 41** I do not want citizens to interfere with our work.

2.2 Crib sheet Factor B

Items ranked +4

- 2** Citizen Science is important, since it contributes to increasing water awareness.
- 37** Citizens often have local knowledge, the water authority should use this knowledge.

Items ranked higher in factor B than in any other factor

- 20** Citizens will only participate in Citizen Science, if participation is in their own interest. **(2)**
- 21** Not all citizens can be trusted to do these measurements. **(1)**
- 29** It is a major bottleneck to create support within the water authority for the deployment of Citizen Science. **(0)**
- 32** The organisation is not equipped to work with large groups of citizen scientists. **(3)**
- 41** I do not want citizens to interfere with our work. **(-1)**
- 42** The water authority should stay in control of doing the measurements, since the water authority is indeed responsible. **(3)**
- 43** I think the creation of Citizen Science does not fall within the tasks of the water authority. **(-1)**
- 44** I do not have a full image of what is possible with Citizen Science. **(0)**
- 45** An important caveat is that citizens will expect that their measurement have a direct influence on policy. **(2)**
- 46** Citizens cannot be motivated to participate in such projects for a longer period. **(2)**

Equally high as factor A, higher than C.

- 7** *Citizen Science is an economic way to collect (extra) measurements. **(1)***
- 8** *Citizen Science enables the collection of more measurements by doing them more frequent. **(3)***
- 13** *I would rather make (smart) use of existing measurements than letting citizens do more measurements. **(0)***
- 17** *Citizens are often underestimated, they are better educated and smarter than we think. **(1)***
- 31** *The conservative character of my organisation is a major bottleneck for Citizen Science. **(-1)***

Equally high as factor C, higher than A.

- 11** *The most important goal is that the measurement data is valuable for the water authority, because time and energy was invested by the organisation. **(1)***
- 12** *I would rather make (smart) use of existing measurements than letting citizens do more measurements. **(-1)***
- 37** *Citizens often have local knowledge, the water authority should use this knowledge. **(+4)***

Items ranked lower in factor B than in any other factor

- 5** It is important to have proper communications to citizens about why values deviate from the norm and what the uncertainty in the measured value is. **(0)**
- 6** I would not know why citizens would not be interested in monitoring water quality. **(-2)**
- 22** With a short training, citizens will be able to do measurements for the water authority. **(1)**
- 23** Citizen Science is an interesting way to give meaning to the concept of citizen participation. **(1)**
- 24** Citizen Science is necessary, because it helps to decrease the gap between citizens and the water board. **(-3)**
- 25** By using Citizen Science, the water board shows that it is keeping pace with the time. **(-1)**
- 27** With Citizen Science one can bind and involve another part of the audience. **(0)**
- 30** The water board will benefit from using Citizen Science in conducting its tasks, because less (financial) resources are available. **(-1)**
- 34** The water authority should incorporate in its policy how to deploy and stimulate Citizen Science more. **(-1)**
- 36** If citizens collect data for the water authority, they shall be compensated for that. **(-4)**
- 38** Citizen Science is important, because it gives insight into the problems that citizens are concerned with. **(0)**

Equally low as factor A, lower than C.

- 14** *Especially schools are suitable target groups to do these measurements, for example during a 'water lesson'. **(0)***
- 16** *Citizen Science is an interesting social innovation, but not suitable to actual collect useful data. **(-2)***
- 26** *An important advantage of Citizen Science is that it reduces the resistance of citizens against projects. **(0)***
- 28** *As long as Citizen Science is not included in the policy at the top levels, the water authority should not invest in it. **(-3)***
- 39** *Citizen should have insight in the most recent information of the water quality that is available with the water authority. **(1)***

Equally low as factor C, lower than A.

- 1** *Providing citizens with insight in water quality will only lead to unnecessary panic and questions. **(-4)***
- 3** *Citizen Science is a resolution to explain why you take certain measures as a water authority. **(-1)***
- 18** *As a water authority we need to learn how to handle the uncertainty of alternative (cheap) measurements that originate from Citizen Science. **(1)***
- 40** *If you provide citizens with a reference framework, they themselves can validate their data. **(-3)***

Items ranked -4

- 1** Providing citizens with insight in water quality will only lead to unnecessary panic and questions.
- 36** If citizens collect data for the water authority, they shall be compensated for that.

2.3 Crib sheet actor C

Items ranked +4

- 2** Citizen Science is important, since it contributes to increasing water awareness.
- 37** Citizens often have local knowledge, the water authority should use this knowledge.

Items ranked higher in factor C than in any other factor

- 6** I would not know why citizens would not be interested in monitoring water quality. **(0)**
- 10** Measurements and observations by citizens are a valuable addition to the official monitoring network. **(-1)**
- 14** Especially schools are suitable target groups to do these measurements, for example during a 'water lesson'. **(2)**
- 15** The most important goal of citizen science is to learn people something about the environment they live in. **(3)**
- 16** Citizen Science is an interesting social innovation, but not suitable to actually collect useful data. **(0)**
- 19** Data collection by citizens is unreliable and should not be accepted by the water authority. **(-1)**
- 26** An important advantage of Citizen Science is that it reduces the resistance of citizens against projects. **(1)**
- 27** With Citizen Science one can bind and involve another part of the audience. **(3)**
- 28** As long as Citizen Science is not included in the policy at the top levels, the water authority should not invest in it. **(-2)**
- 39** Citizen should have insight in the most recent information of the water quality that is available with the water authority. **(2)**

Equally high as factor A, higher than B.

- 5** *It is important to have proper communications to citizens about why values deviate from the norm and what the uncertainty in the measured value is. **(1)***
- 22** *Not all citizens can be trusted to do these measurements. **(2)***
- 23** *Citizen Science is an interesting way to give meaning to the concept of citizen participation. **(3)***
- 24** *Citizen Science is necessary, because it helps to decrease the gap between citizens and the water board. **(2)***
- 30** *The water board will benefit from using Citizen Science in conducting its tasks, because less (financial) resources are available. **(0)***
- 38** *Citizen Science is important, because it gives insight into the problems that citizens are concerned with. **(1)***

Equally high as factor B, higher than A.

- 11** *The most important goal is that the measurement data is valuable for the water authority, because time and energy was invested by the organisation. **(1)***
- 12** *I would rather make (smart) use of existing measurements than letting citizens do more measurements. **(-1)***
- 37** *Citizens often have local knowledge, the water authority should use this knowledge. **(+4)***

Items ranked lower in factor C than in any other factor

- 4** Water quality is an abstract concept, citizens will not understand what they measure. **(-3)**
- 8** Citizen Science enables the collection of more measurements by doing them more frequent. **(1)**
- 9** Citizen Science enables the collection of large amounts of measurements. **(0)**
- 13** The greatest challenge is how to teach people something, if they can or want to spend little time on it. **(-1)**
- 17** Citizens are often underestimated, they are better educated and smarter than we think. **(0)**
- 20** Citizens will only participate in Citizen Science, if participation is in their own interest. **(-2)**
- 31** The conservative character of my organisation is a major bottleneck for Citizen Science. **(-2)**

Equally low as factor A, lower than B.

- 29** *It is a major bottleneck to create support within the water authority for the deployment of Citizen Science. **(-1)***
- 32** *The organisation is not equipped to work with large groups of citizen scientists. **(0)***
- 33** *My organisation has no capacity to work with all this data. **(-2)***
- 41** *I do not want citizens to interfere with our work. **(-4)***
- 43** *I think the creation of Citizen Science does not fall within the tasks of the water authority. **(-2)***
- 44** *I do not have a full image of what is possible with Citizen Science. **(-1)***
- 46** *Citizens cannot be motivated to participate in such projects for a longer period. **(-1)***

Equally low as factor B, lower than A.

- 1** *Providing citizens with insight in water quality will only lead to unnecessary panic and questions. **(-4)***
- 3** *Citizen Science is a resolution to explain why you take certain measures as a water authority. **(-1)***
- 18** *As a water authority we need to learn how to handle the uncertainty of alternative (cheap) measurements that originate from Citizen Science. **(1)***
- 40** *If you provide citizens with a reference framework, they themselves can validate their data. **(-3)***

Items ranked -4

- 1** Providing citizens with insight in water quality will only lead to unnecessary panic and questions.
- 41** I do not want citizens to interfere with our work.

